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INC

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THE UNITED GAS IMPROVEMENT COMPANY,

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AFFORDING { PERFECT CONTROL OF GENERATOR FIRE CONDITIONS.

PRODUCING { UNIFORM RESULTS. HIGHEST EFFICIENCIES.

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GAS TESTING ORDINANCES.

SECOND ARTICLE.--THE COMING OF CALORIMETRY.

By JACQUES ABADY, London, England.[1]

In another article in respect to Gas Testing Ordinances, termed "The Passing of Luminosity," I endeavored to lay down several reasons why the existing luminous-flame standard of gas quality should be replaced by a calorific standard, and at the same time I tried to point out some of the questions and difficulties which surround such replacement. As stated at the end of the previous article, I now propose to deal with the rationale of Calorimetry, which for the purpose of clearness of discussion, might be divided under the following headings:

1. On what basis should a calorific standard be fixed?
2. Should it be "net" or "gross"?
3. Can calorific testing be standardized?

With respect to many of the technical details which surround the theory and practice of Calorimetry, I think that in no country have they been so thoroughly dealt with as in the United States, and readers of the AMERICAN GAS LIGHT JOURNAL will be familiar with all the points raised in numerous articles, and in the communications of the Bureau of Standards. It is not proposed, therefore, to deal in detail with many of these points, but rather to direct attention to the three headings set out above.

ON WHAT BASIS SHOULD A CALORIFIC STANDARD BE FIXED?

I think it follows from the argument introduced in my first article that the calorific power should not be fixed on a basis of what the calorific equivalent to a gas supply under a candle power standard happens to be. The reason of this is that the candle power standard carries with it a "luminous constituent" conception, whereas a calorific standard does not necessarily do so.

Various standards of calorific power now obtain in different cities and countries, and it indeed seems difficult to decide what the proper figure should be. I observe that suggestions that have been made with respect to calorific power in the United States seek to differentiate between carburetted water gas and coal gas; and it really appears to me that, in view of diverging methods of manufacturing gas, it is next to impossible to arrive at a universal figure. I can, however, see no valid reasons for the suggested differentiation referred to above, because, as standardization seems impossible, it is tolerably certain that the guiding principle should be, firstly, to fix a standard which will enable the greatest amount of heat units to be sold for the least amount of money; and secondly, to have sufficient elasticity in the ordinance so as not to hamper the gasmaker's free choice of carbonizing materials and methods. I do not see that either of these desirable elements are ensured by fixing a carburetted water gas standard higher than coal gas, or *vice versa*. It may be that developments in gas manufacture might bring about in the next few years the economically possible production of gas of a much lower calorific power then that which is now sold. It may further be possible, for instance, to extract in a practical way benzol from gas, and thus leave behind a residual gas of a lower calorific power, but at a more than proportionately lower price.

For reasons such as these, therefore, it seems to me that ordinances fixing calorific standards should either be sufficiently elastic in the standard fixed (with references always to the price fixed) or arranged to be frequently reviewed so as to enable any adjustment to be made in the standard of quality called for, as circumstances may from time to time render possible.

Of course, anything enacted as a law can also be amended, but the principal requires establishing that those responsible for the manufacture of gas are from every point of view the best judges of the most economical product to be supplied to the public, and they should be in a position to express their views with a greater freedom, and those views should be received by the regulating authorities with a greater absence of suspicion than at present. So far as I am able to judge, desirable spirit of co-operation between Bureau of Standards and American gas engineers does appear to exist.

In this connection, Circular No. 32 of the Bureau of Standards, states as follows:

"In any city with given facilities for fuel supply, labor supply, outlet for by-products, and other factors fixed, there is some certain kind and quality of gas which will permit manufacture and sale of the maximum amount of heat for a dollar. It is often difficult to determine just what is best, but usually a close approximation can be made by an experienced engineer. Knowing this kind and quality, it should be the one selected for that city, because the desirable quality of gas to be supplied is independent of the price previously charged for gas. That is, the price to be charged for gas to be fixed entirely on the operating costs and investment necessary for this gas in the city in question. Obviously in some cities the price for gas may properly be more than in other cities, even though the quality be the same."

After making this statement, the same circular proceeds to endeavor to prove that with a higher heating value the number of British Thermal Units delivered for one dollar will be more. This assumes a certain artificial relationship of manufacturing cost and distribution charges to B. T. U. per cubic foot; but when I make use of the statement that the object of any gas ordinance should be to enable a suitable gas containing the largest quantity of heat units to be delivered for the smallest amount of money, I mean, of course, the net price to the consumer. If it so happens that it does not pay the manufacturer to fall below 600 B. T. U., then this, of course, would be the figure to fix, but I think from various manufacturing considerations, some of which I have pointed out above, that the adherance to a figure as high as this may, to say the least of it, be detrimental to the interest of the consumers. What I suggest is that in many cases the calorific power at the present time has been fixed at the figure which happened to be the supposed equivalent to an existing candle power standard, and I certainly think that this principle is altogether wrong.

To summarize, then, the conclusion that one arrives at is that it is easy to say on what basis the calorific standard should *not* be fixed, but that the alternative to this proposition is one best left to the gasmaker to fix and adjust from time to time in co-operation with the regulating authorities.

SHOULD A CALORIFIC STANDARD BE NET OR GROSS?

At one time there was a disposition to hold the view that, because when gas is used for many purposes, the products of com-

1. Mr. Abady's first article appeared in the JOURNAL of Nov. 9.

bustion are not cooled to atmospheric temperature without condensation of the water vapor formed, therefore the "net" value should be the basis of the terms in which calorific power is expressed. This view is now no longer held, due to a very great extent to the efforts of American engineers, and of the staff of the Bureau of Standards at Washington; and it is only right that full acknowledgement of this fact should be made. The view that "net" value is an artificial expression which does not correspond to any of the heating effects obtained from gas under any circumstances, is now the prevailing one. This is perhaps natural, now that calorimetry is so much better understood than it was in its early days, and those who object to "net" value have received powerful support in England from the Metropolitan Gas Referees, whose notification contains the following paragraph, which can generally be agreed with, and requires no amplification:

"The heating or calorific power of any sample of gas is represented by the number of calories produced by the combustion of one cubic foot of such gas measured at 60° F. and under a pressure of 30 inches of mercury. When the products of combustion are cooled before they escape, the heat imparted includes that which is due to the condensation into water of some of the steam formed by combustion, and that which is due to the cooling of the water thus formed from its boiling point to a lower temperature. The maximum calorific power which gas can thus exert is determined directly by the calorimeter. This is a true measure of the total heating power, and is termed the gross calorific power of the gas. But in many cases in which gas is used as a heating agent the steam which is formed escapes into the air uncondensed, and thus the heat due to the condensation of the steam and the cooling of the water so formed is not utilized. The amount of heat thus lost can be estimated, and if it is subtracted from the total heat yielded by the combustion of gas in the calorimeter another value is obtained which is termed the net calorific power of the gas. Since, however, when steam escapes uncondensed the uncondensable products of combustion also pass away at a high temperature, and since the loss of heat thus arising is commonly the greater of the two, the customary partial correction from gross to net has not much significance. The difference in degrees centigrade of the temperature of the effluent gas and of the surrounding air shall be taken, and one sixth of this difference shall be added to the result previously found if the effluent gas is the warmer of the two; or subtracted if the effluent gas is the cooler of the two. The result is the gross calorific power of the gas in calories per cubic foot. This correction has been found by experiment."

There is one sentence, however, with which it is not easy to agree, viz.; "that the maximum calorific power which has can thus exert is determined directly by the calorimeter. This is the true measure of the total heating power and is termed the gross heating power of the gas."

Now it is quite clear to those who have studied the matter that the gross calorific power does *not* represent the true maximum calorific power, but that the proper term for the true maximum calorific power is "Total Heating Value," which has been defined by the American Gas Institute as follows:

"The heating value of a gas is the total heating effect produced by the complete combustion of a unit volume of the gas, measured at a temperature of 60° F., and a pressure of 30 inches of mercury, with air of the same temperature and pressure, the products of combustion also being brought to this temperature. In America the unit of volume is a cubic foot, and we recommend that the heating value be stated in the terms of B.T.U.'s per cubic foot of gas."

An examination of this definition will show that it eliminates the differences, due to humidity, which are almost invariably present in practice and invariably influences the calorific value shown by the calorimeter, which is thus the "gross," but not the "total heat" value. That the "net" differs from either the "gross" or "total heat" will be clear from what has been quoted from the notification of the Metropolitan Gas Referees. It seems to the writer that logic and expediency both point to the facts:

(*a*) That "net" value is purely artificial and is never reproduced in practice.

(*b*) That "gross" value, as observed from a calorimeter, is subject to influences other than changes in calorific power of gas, and is therefore not an accurate expression.

(*c*) That "total heat" is a proper measure of the calorific value of a sample of gas.

"Total heat," value is therefore worthy of full consideration, and this can be appropriately discussed, for it is bound up with the question outlined by the next heading, viz:

Can Calorific Testing be Standardized?

Bearing in mind the above explanation of total heating value, and recollecting that this expresssion eliminates variations in the apparent calorific power, due to differences in temperatures, humidity and other details, I shall try to show that it is possible to standardize calorific testing so that the "total heat" value is always expressed directly from the instrument itself. The definition is taken from a report of Committee on Thermal-value and Candlepower, which was written for the 7th annual meeting of the American Gas Institute, October, 1912.

On page 5 of this report there occurs the following paragraph;

"How far the variance between the total heating value and the gross heating value, as determined by the modern flow-calorimeter, approved by the Institute's Committee on Calorimetry, and, when operated under rules and observing the precautions set down by the committee, will extend, can be determined by a perusal of the reports of that committee; but we earnestly recommend to our Committee on Calorimetry, the Bureau of Standards at Washington, and others, the necessity of devising a calorimeter that will permit of the total heating value of a gas to be determined to a close approximation to accuracy by observations on an instrument that can be used under the same general conditions that now obtain with the use of the present flow-calorimeter."

In response to the suggestion of the necessity of devising a calorimeter which can be read in total heat value, Mr. John Frederick Simmance (whose labors in connection with calorimetry are well known, and the more appreciated the more they are known), has, in conjunction with the writer, devised such a calorimeter, which has been appropriately termed "The Total Heat Calorimeter." This instrument has so far passed out of the domain of the laboratory as to be already the standard in use under several of this year's English Gas Statutes, as also throughout the Dominion of Canada.

This article, up to the present—although expressing the personal views of the writer—has been, in a sense, impersonal; but; seeing that the American Gas Institute Committee made such a definite request, and seeing that Simmance and the writer appear to be the only workers who have endeavored to comply with the request, it becomes a necessity that the writer should proceed to describe the means by which the "total heat" value is obtained from this calorimeter.

Obviously, the easiest way to explain the calorimeter is to append an illustration of it, and to accompany this illustration with particulars.

It should be remembered that, when gas is burned in a flow-calorimeter, and when the corrected volume of gas burned, the amount of water collected and the temperature rise are noted, it is also necessary to ascertain the following data in order to convert the calorific reading which will be "gross" or "observed value" into "total heat" value.

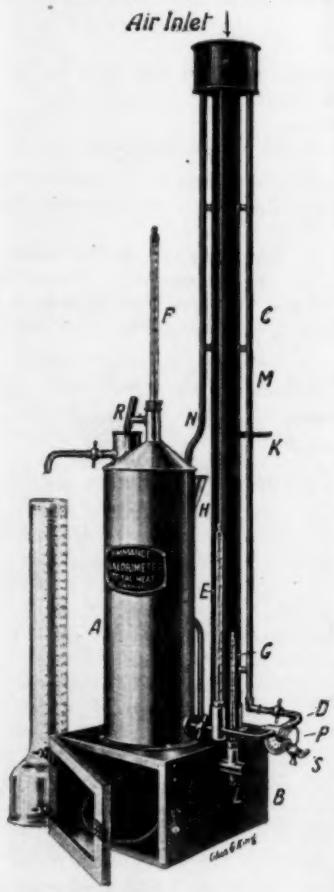
(*a*) Percentage saturation of the gas tested.
(*b*) The volume of air passing through the calorimeter during the combustion of each cubic foot of gas.
(*c*) Percentage saturation of such air.
(*d*) Temperature of such air.
(*e*) Volume of products leaving the calorimeter per cubic foot of gas burned.
(*f*) Percentage saturation of such products.
(*g*) Temperature of such products.

From these data, it is necessary to obtain, firstly, the heat difference due to the relative saturation of the inlet air and outlet products, and secondly, the heat difference due to sensible heat of the products, which will depend upon the respective temperatures of the air entering and the products leaving the calorimeter.

The Metropolitan Gas Referees instruct gas testers to make a correction, but their correction only deals with the latter of these points; and if a moment's thought is given to the problem, it will be seen the correction of the data for each experiment and the application of these data to formulae are tedious matters.

The total heat calorimeter, illustrated, automatically ensures, first, a constant balance of volumes of gas and air entering and products leaving; second, a practical agreement between the temperatures of cold water, inlet air and outlet products; and third, freedom from humidity differences of air and gas entering and products leaving. It therefore makes it unnecessary to obtain any of the above enumerated data, or to apply either of the above rated corrections; and it is suggested that an examination of the principles upon which the instrument works will show that it always, and under all conditions, indicates automatically the maximum heat in the gas, or in other words, the total heating value in accordance with the definition set out on page 5 of the Report of Commit-

tee on Thermal Value, quoted above. I think it will also be plain that the instrument embodies no complications which prevent it from being "used under the same general conditions that now obtain with the use of the present flow calorimeter."



The calorimeter body, *A*, is constructed with as small a water content as is reasonably possible, and unless it can be demonstrated that the instrument does not do what is claimed for it, it is clear that the calorimeter body also must allow of a thorough extraction of heat from the products due to the gas burned. This body, *A*, is stood on the box, *B*, the top of which consists of a metal base plate with a annular compartment in which, as a matter of fact, the calorimeter stands, and which, being filled with water, seals the calorimeter. It may be convenient to remark that any liquid products which are condensed, flow over the surface of this water and are collected at the outlet, *L*, if at any time it is required to know the amount of condensation. The inlet water thermometer is at *E*, and the outlet water thermometer at *F*, but both these thermometers can be placed on the upper part of the calorimeter side-by-side if it is thought desirable. The burner is stood in a prepared place in the burner box, *B*, which has a glazed front, so made as to clamp absolutely tight and prevent the ingress of any air whatever, to support the combustion at the burner in this box. The calorimeter so far described is of the ordinary flow type, and operates by a change-over tube, *R*. It can be used in conjunction with a graduated glass measure for collecting the water, or in connection with an apparatus for weighing the water collected if this is thought desirable. In England, we do not think the difference between the volume and the weight of water at the different temperatures which occur to be sufficiently important to warrant the trouble of weighing it, in contra-distinction to the obviously more convenient method of measuring in a graduated glass vessel accurately calibrated at a suitable mean temperature.

The real essence and characteristic of this instrument lies in the arrangement now about to be described, which in conjunction with the burner box constitutes the means by which the "Total Heat" is obtained directly from the reading of the calorimeter. It consists of a tube, *C*, which sockets onto the base plate of the calorimeter stand (the burner box), and has at its upper end a constant level overflow inlet-water funnel to which are attached tubes, *M*, and *N*. The tube, *M*, conveys the cold water from the overflow funnel to the calorimeter through which it circulates; and the tube, *N*, is a safety guide through which the water must always be running as an auxiliary overflow, to ensure a sufficient head so that the top of the tube, *M*, is always covered with water, and by this means the carrying down of air with the water through the calorimeter is avoided. Down the tube, *C*, the overflow also passes and is carried away at its base, but the air is also carried down this tube, *C*, and feeds the burner supplying the necessary air for the combustion. It will be recollected that the burner is in a box which has no other means of air ingress. Now, the air which thus enters the burner chamber has passed through the cold water, and it is found in practice that this ensures three things:

(*a*). The cold air is practically the same temperature as the cold water.

(*b*. The air is completely saturated at the temperature at which it enters.

(*c*). The rates of flow of the air and water are constant.

(*d*). In consequence of the above facts, the products of combustion are also regulated, their temperature being practically the same as both the inlet air and the cold water, and they are also saturated.

The device appears to the writer (who is naturally familiar with it) to be perfectly simple, and it certainly renders automatic the attainment of the necessary constancy or balance of volumes, temperatures and humidity, which together contribute to the actual observation by an instrument of the total heat value of the gas. It is an advantage of this instrument that when the gas is lighted and the water turned on, nothing that the experimentalist can do can alter the constancy or balance; and, seeing that tests, both official and unofficial, must often be made by asssistants who are not skilled techniticians, this advantage is one that it is impossible for a practical engineer to overlook.

There is one criticism which might be brought against this instruments, viz.: that if the air enters saturated, and the products leave at the same temqerature also saturated, and as there is a contraction in volume as between products and inlet air, it follows that more water vapor is condensed (giving up its latent heat) than is actually due to the combustion of the flame. This is perfectly true, but if it is worked out it amounts, under the most extreme conditions, to (say) 2 B.T.U.'s; that is to say, the calorimeter reading is too high to this extent. This error in high reading is, however, practically eliminated by the fact that the automatic temperature balance is so arranged that the products leave at a slightly higher temperature than the entering air, thus carrying away an increased amount of water vapor due to the higher temperature, and rendering, as repeated experiments have shown, the reading of the calorimeter in total heat value to be practically correct.

It may be that as I place the details of this instrument definitely before American engineers, as a compliance with the request contained in the Institute's Report on Thermal Value, the example thus shown may be followed by American engineers, and experiments and investigation continued on these lines, the details of which will no doubt, be of interest when the United States patent specification is available for public perusal.

The conclusion which I am led to by an examination of the underlying principles and, by experience with the practical results of this device, is that this method does ensure the return by a calorimeter of the maximum or Total Heating Value of gas tested in it quite independently of external conditions of temperature and humidity. Seeing further that it can be applied (and as a matter fact is applied) to a calorimeter body with sufficient capacity to absorb the heat from a gas of a high as well as a gas of a low calorific power, it seems to me that the reply to the question, "Can Calorific Testing be Standardized?" is answered in the affirmative.

In view of the fact, as stated, that the "total heat" value has been adopted in British Acts of Parliament, it may possibly be interesting to American readers if in conclusion I append some clauses which show how the matter is dealt with in the phraseology of the Acts:

1. The Company shall provide and maintain at each of the prescribed testing places the calorific power of the gas supplied by them, a calorimeter to be agreed upon between the company and corporation, or failing agreement, to be approved by the Board of Trade; which shall be so constructed as to be capable of yielding the total heat value of the gas expressed in British Thermal Units."

2. "The calorific power of the gas supplied by the company shall, when tested and corrected in accordance with the provisions of this Act, be 540 British Thermal Units per cubic foot of gas, and that power is hereinafter referred to as the 'Standard Calorific Power.'"

3. "The calorimeter shall be so used as to yield the total heat value of the gas which shall be developed by the complete combustion in moist (saturated) air of moist (saturated) gas, and the products of combustion shall be cooled down to the temperature of the air.

4. "The result obtained by means of such testing shall be expressed in terms of 1 cubic feet of gas, and shall be corrected for a temperature of 60° Fahrenheit and a pressure balanced by a column of 30 inches of mercury at the same temperature. The corrected result shall be deemed to be the calorific power of the gas ascertained by the testing."

Note—The illustration of the Calorimeter is that which appears in the Canadian Government official instructions for calorific power testing.

Shot Holes in Holder.

It is reported from Amiens that in a bombardment of that city by German aeroplanes, a bomb fell in the gas works and did considerable damage. Missils from the exploding shell penetrated the holder sheets, and the escaping gas was ignited; but the works' force extinguished the fire, and stopped the holes.

[Continued from page 369.]

The Care and Maintenance of Gas Holders.

Repairs - Paints and Painting—Heating Cup and Tank Water—Snow Removing—Improved Construction.

[By J. H. BRAINE.]

REPAIRS.

Major repairs, such as renewal of distorted members, etc., will, of course, have to be done by the holder builders.

Minor repairs, patching, caulking seams, drilling drain holes, sealing tank walls, adjusting rollers, etc., can be done very well by a small gang of skilled men in the company's employ. As a general rule it is good practice to complete all minor repairs, overhauling etc., just prior to painting. This procedure is carried even further by the writer's company; all cleaning of water pockets and general renovating of the holder being done by a special gang before the painters come on the ground. General overhauling is found to effect an economy, as when the large painting gang arrives their work is uninterrupted.

It has been found necessary to equip repair gangs with special tools to reach places difficult of access. Figs. 10 and 11 show these tools.

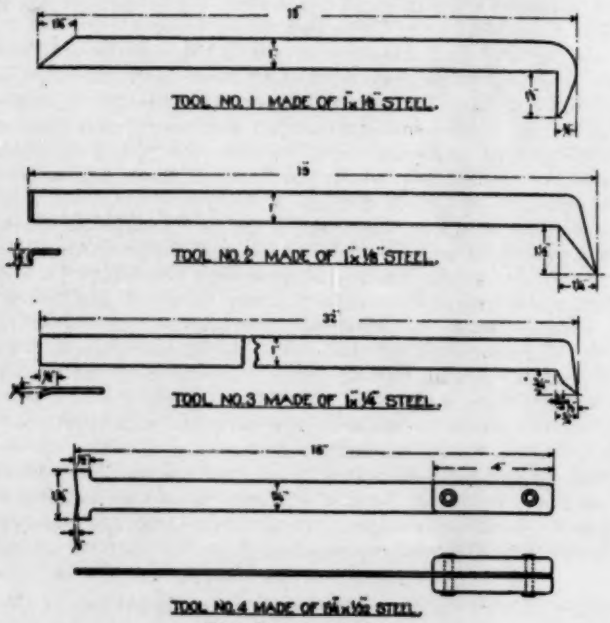


Fig. 10.—Repair Tools.

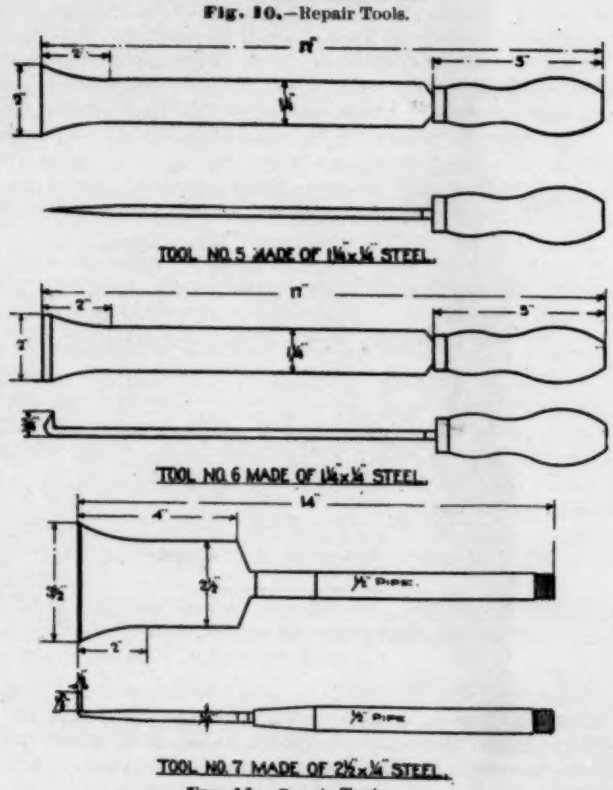


Fig. 11.—Repair Tools.

Tool No. 1.—For cleaning out pockets formed by junction of lattice bars and chord angles, in the latticed type of standard supports.

No. 2.—For cleaning behind vertical legs or stiffeners on sections, where space is 1/8 inch to 1/4 inch.

No. 3.—For same use as No. 2 where space is 1/4 inch or more. Made long so as to give enough spring to reach all points behind the leg.

No. 4—For same use as No. 2, where space is less than 1/8 inch.

No. 5.—General scraper for flat surfaces.

No. 6.—General scraper for pockets.

No. 7.—Cup scraper. Has pipe handle 3 to 4 feet long.

All the tools are, of course, used for a variety of purposes, but were made for the special use stated. Regular stock scrapers used by painters are not shown.

For applying patches on plates, or replacing rivets in leaking seams, a very good bolt is shown in the "Catechism of Gentral Station Gas Engineering," issued by the Trustee' Gas Educational Fund. A bolt adopted by the writer is shown in Fig. 12. Many

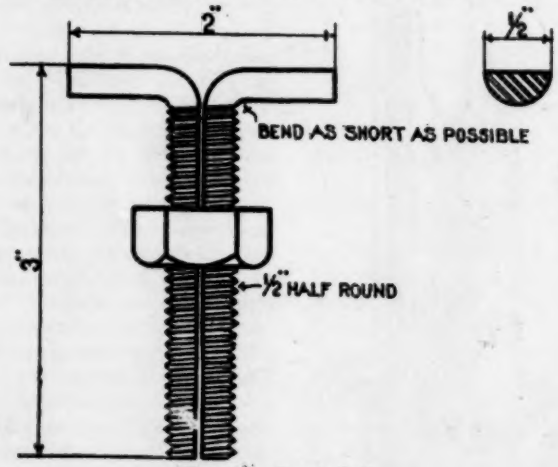


Fig. 12.—Repair Bolt.

engineers, however, prefer to use a tap screw, or resort to the method known as "fishing." This is done by dropping a line through the hole in which it is wished to insert a bolt, and drawing the line up under the bottom curb of the outer section by a long hook of heavy wire; attach the bolt and draw the bolt into position by the line. A similar method in the case of leaks at rivets in steel tanks, is to drive out the rivet and force a float consisting of a sealed bottle or cork attached to a line through the hole, allowing this to float to the surface of the tank, where the bolt is attached to the line and drawn into position. The writer has not seen this done, but is assured by competent authority that it is possible. Holders can be cleaned while in service, with sandblast. There are several concerns manufacturing apparatus for this purpose, and many contractors are equipped to do this work. While it is expensive, in the case of holders which have been neglected or improperly painted and cared for, it may be the cheapest method in the end.

It is good practice to require that all small tools used aloft be fastened to the wrists or belts of workmen using them, as this may avert serious injury to fellow workmen, or others.

PURGING.

When major repairs are to be undertaken, necessitating the landing of the holder and purging it of gas, the following procedure is recommended:

1. Remove all oil from surface of tank water by means of the skimmer in place, or if no skimmer was provided, by a temporary skimmer. In the latter case, the holder will have to be raised to its full height in order to introduce the temporary skimmer under the bottom of the outer section.

2. After this oil has been removed the holder should be landed, and all connections sealed, and one of the manhole plates removed. In place of this manhole plate, a similar plate should be installed, with a steam jet blower connected thereto; with a valve between this blower and manhole plate the full size of the blower discharge. This valve should be kept closed until ready to raise the holder. An outlet closed by a blank flange, and of the full size of blower discharge, should be provided above the valve, the use of which will be explained later. The smaller sizes of blowers can be conveniently connected from the steam piping on guide frame by flexible hose.

3. When this apparatus is in place, turn steam into the blower and raise the holder as rapidly as possible. As a wise precaution, if

metallic hose is used, insert a nipple of rubber hose, not wire-wound, between the blower and metallic hose to prevent any possibility of stray electric currents carried on the holder or guide framing arcing during the operation. There will be a time during this operation when an explosive mixture will be present in the holder, and air should be introduced as rapidly as possible while passing this point. The tabulation below will serve to indicate when the danger point is passed :

Exglosive Properties of Mixture of Gas and Air.

Gas, per cent.	Air, per cent.	Result.
Up to 9	91	No explosion.
From 10 to 12	90 to 88	A very slight explosion.
From 13 to 14	87 to 86	A slight explosion.
From 15 to 18	85 to 82	A hard explosion.
From 19 to 20	81 to 80	A very hard explosion.
From 21 to 22	79 to 78	A hard explosion.
At 23	77	A slight explosion.
From 24 to 25	76 to 75	A very slight explosion.
From 26 upwards	74 downwards	No explosion.

Mixtures begin to explode when they contain 10 per cent. gas and 90 per cent. air. Explosions increased in strength until a maximum at 19 per cent. gas and 81 per cent. air. They then decreased in intensity until the mixture contained 26 per cent. gas and 74 per cent air, when the explosions ceased.

These experiments were made under laboratory conditions. When purging a holder, especially if steam is used, oil vapors will form, which will be explosive when the percentage of air is higher than noted in the tests. The writer has exploded mixtures containing as high as 93 to 94 per cent. of air.

When it is certain that the explosive point is passed, it is well to continue the air injection as long as possible, in order to reduce the odor in the neighborhood when the air is let out of the holder. The steam may now be shut off, and the air allowed to pass out through the outlet above the valve, which is protected by double gauzes, 1 foot apart, of 900 meshes to the square inch, the descent of the holder being controlled by this valve. The air intake in the blower should be closed by a blank flange during this operation. This precedure should be repeated a sufficent number of times to insure all gas, or mixture of gas and air, being diluted and purged out.

4. After the holder is finally landed, a second manhole plate should be removed and one substituted upon which is installed a sheet metal purging pipe equipped with gauzes, and either connecting with a canvas duct running up holder frame, or if the holder is in an insolated neighborhood, the metal purge pipe may be carried only sufficiently high to be above the workers on the holder. Steam should now be turned into the injector again, and the crown purged until it is sufficiently free from gas to allow of the work proceeding. Trouble will be encountered here from the fact that vapors will form from the oil left on top of tank water after skimming. If this vapor continues to form after considerable purging, it may be necessary to introduce live steam at several points on the holder to vaporize the oil.

5. The tank can now be pumped out and the sludge removed from the bottom. This will probably give off a strong odor and some vapor, and great care must be used to see that air is pure before allowing men to enter.

Painting.

"It is not my intention to advocate any particular paint or covering, but I will point out the necessary properties of a good protective paint.

The first coat applied should form a hard foundation, and should possess adherent qualities for succeeding coats, as if the first stays soft the succeeding coats will crack, and if it is not adherent, the succeeding coats will peel off.

"The covering should also be a non-conductor, as it must be capable of opposing the admission of outside influences which will cause an electric current to pass through or over the surface of the metal. The constituents of the covering should in themselves be inhibitive of corrosion, and should negative the action of the molecules in the metal which tend to produce electrolytic action.

"The constituents should not be soluble in water, for if so, the paint will soon disintegrate, and upon dissolving they might form compounds in the cup or tank water which would accelerate electrolytic action.

"It should also be impermeable, as if it is porous, and moisture finds entrance into the body, the means for producing corrosion are immediately at hand."

It is safe to say that considerable deterioration of modern holder structures is due to the perfunctory nature of the painting and lack of care in selecting paint, oil, etc. Unskilled labor also contributes to the failure of paint to properly protect the surface to which it is applied. As a general rule, painters under the direction of a skilled foreman, will save money in the long run. Contractors will usually take a painting job cheaper than it can be done by the company's employees, but they have not the same interest, and it is impossible to compel them to exercise the conscientious care that will be given by a company's employee to whom the result is more of a credit than the completion of the work.

In taking up painting, I cannot do better than quote from Mr. F. P. Cheeseman, in *The Painters Magazine*, May, 1914.

"A great advance has been made in technical paint knowledge during the last 10 years, due largely to the experiments conducted under the auspices of various associations. We will state briefly a few of the results announced:

"The quality of structural iron and steel used to-day is quite different from that originally made; and this has necessitated a change in the composition of paints for structural metal.

One thing must be remembered, on some steel it is impossible to get anything that will stand, as the steel will eat up and destroy any protective coating; and the paint that stands well on one structure will go to pieces on another, simply from this cause. It is impossible to make a standard paint formula that will suit all climatic conditions, hence to obtain the best results the paint should be made to suit the location, time of year, and character of the work. * * *

Spreading Power.—"On a surface which does not absorb any paint, you can approximate the average thickness of a coat thus:

"The liquid gallon contains 231 cubic inches, and if 1 gallon of paint is spread over a smooth metal surface containing 231 square feet, the paint will average $\frac{1}{114}$ inch thick. If the paint be spread to cover 462 square feet to the gallon, it will be $\frac{1}{288}$ inch thick.

"There is, of course, a limit to spreading power, and when you go beyond 800 to 850 square feet per gallon you are doing so at the expense of durability.

Primary Coat on Metal.—"The most important fact brought out by tests is that poor results are obtained by using a graphite or carbon pigment paint for priming or shop coats, and it is generally conceded that graphite or carbon are stimulators of corrosion when used next to the metal, but when used as finishing over a selected priming coat good results are obtained. The best pigments for priming coats are red oxide, and metallic brown pigments of selected grade, red lead, blue lead, and magnetic black oxide. Dry red lead cannot be properiy mixed by hand, as an uneven coating would be given—in some places too much pigment, and in others practically no pigment at all. The lead companies recognize this fact and recommend red lead paste. It would be better if they went a step further and recommended the use of ready-mixed red lead containing about 75 per cent. of red lead, the balance selected inert pigments, and the vehicle pure linseed oil with a small percentage of drier.

Vehicles.—"There is a difference of opinion as to whether the life of the paint is due to the oil or the pigment. In our opinion neither can be given the whole credit the life or durabilityof the paint being due to the proper combination of the two. The oil vehicle should be well aged linseed oil, and in most cases greater durability is obtained by using raw oil. Linseed oil is not the ideal vehicle, but nothing better as yet has been discovered for universal painting requirements; but for some locations Chinese wood oil and treated fish oils can be used to advantage.

Painting Steel Structures.—"The durability of painting on steel bridges is not so much a question of season as of favorable weather. Extreme heat or cold are equally detrimental. Extreme heat causes paint to dry rapidly and therefore unnaturally; extreme cold retards the drying and also causes unnatural drying. When an oil paint dries naturally it absorbs the requisite amount of oxygen, but if forced by extreme heat, or by the addition of artificial driers, its durability is impaired. If you scrape or sand-blast a structure, exposing the bare metal, the cleaned surface should not be left unprotected over night, but should be painted immediately.

"To find the paint required for the structual iron of a building take the estimated weight of the framework, say 450,000 pounds, of an average thickness of $\frac{5}{16}$ inch. A square foot of $\frac{5}{16}$-inch iron weighs 12.75 pounds. Dividing the total weight, 450,000 by 12.75 gives 35,300 square foot one side. As both sides are to be painted, double this, making 70,600, and add 5 per cent. to cover top and bottom; take about 74,000 square feet.

Painting Steel Imbedded in Concrete.—Within recent years it has become recognized that structural steel embedded in concrete should be protected with a paint coating; because in many cases the steel has been found corroded, and the concrete forced away from the steel by rust, causing cracking, and destroying the bond between con-

crete and steel. It is also known that the lime in concrete will destroy linseed oil paints. It is, therefore, recommended that steel which is to be encased with concrete, should have as priming coat applied to the bare metal, a high grade linseed oil oxide of iron paint, and over this at least one, preferably two, coats of a paint that does not contain any linseed oil."

It is to be hoped that reliable test data will. in the course of time, be forthcoming as a result of the vast amount of work done by those conducting experiments. In the meantime, we are left to our own resources in selecting paints for holders, but it seems safe to say that those of us who are using a red lead priming coat, and either iron oxide, red lead, or carbon paints for a finishing coat, are at least on the conservative side. It is safe to say that the vehicle of all paints, both priming and finishing coats, should be of pure linseed oil, except for paints to be submerged. A number of proprietary articles are offered as substitutes for red lead or oxide as a priming coat for steel, and several of them are doing very well under exposure tests, but the length of time they have been exposed under the writer's observation, is not sufficient to warrant an opinion. It is interesting to note that the chief difficulty in the use of red lead has been removed, as it can now be secured ground in oil, approximately 97.8 per cent. of pure red lead, and which will not "set up" if exposed to the atmosphere and not immediately used. In the work by Cushman and Gardner, a tabulation is given showing tests of the power of various paint films to exclude moisture. In these tests, iron oxide stands first; white lead, second; red lead, eighth; with carbon and graphite well down the list. If these experiments are taken as conclusive, which, however, the authors do not claim, it is of interest to those of us who have been using an iron oxide finishing coat to note that it is classed as the best excluder of moisture.

Tests of Paints.—The best test for paints destined for use on exposed structures is, of course, a practical test on a portion of such structure. Other tests are resorted to hasten the process of nature, but I do not think that anyone will claim valuable results from them. It is not possible to say definitely that samples of paints furnished are exactly similar to those previously examined. It is, however, a wise precaution to send samples of all mixed paints, red lead, white lead, and linseed oil to the laboratory, as any shortage of pigment, or gross adulteration of the vehicle, or the use of driers detrimental to the life of the paint, can be discovered. In general, it may be said that anyone who is using paint that appears fairly uniform in composition, and which has adequately protected the structure on which it was applied, should continue to use it, rather than start experiments which may be costly and embarasing. Assurance should be had, however, that the manufacturer is reliable, and will not change its composition without your knowledge. Before leaving the subject of composition of paint, it might be of interest to note the following analyses of paints that have given good service. The wide variation in composition bears out the statement that we have still much to add to our knowledge of paint products.

RED HOLDER PAINT NO. 1.—*Analysis of Pigment.*

	Per Cent.
Calcium carbonate	65.79
Iron oxide, Fe_2O_3	22.90
Silica, SiO_2	4.40
Loss on ignition	4.46
Undetermined	2.45
	100.00

The vehicle was linseed oil, containing 24.83 per cent. of mineral oil. There is also present some organic dye which prevents the determination of the constants of the linseed oil, by imparting a reddish color to it. The dye is not soluble in water, and if the paint were exposed to rain, the color would not likely be washed out.

RED HOLDER PAINT NO. 2.—*Analysis of Pigment.*

	Per Cent.
Alumina, Al_2O_3	1.90
Calcium oxide, CaO	1.14
Iron sesquioxide, Fe_2O_3	63.74
Magnesium oxide, MgO	0.77
Silica, SiO_2	19.62
Sulphur trioxide, SO_3	0.43
Loss on ignition	4.88
Undetermined	7.52
	100.00

This pigment is probably a natural bright red oxide.

Analysis of Vehicle.

Acid number	4.12
Iodine number	165.3
Hexabromides	28.18
Saponification number	190.38
Specific gravity at 15.5° C.	9.941

This vehicle is linseed oil.

RED HOLDER PAINT NO. 3.—*Analysis of Pigment.*

	Per Cent.
Alumina, Al_2O_3	4.20
Calcium sulphate, $CaSO_4$	31.16
Iron oxide, Fe_2O_3	31.02
Silica, SiO_2	12.28
Organic matter and water—by difference	21.34
	100.00

Analysis of Vehicle.

Acidity	1.24
Hexabromides	53.3
Iodine number	165.7
Saponification number	197.4
Specific gravity at 15.5° C.	0.9365

This is a good linseed oil; does not contain any turpentine, rosin oil, or fish oil.

RED OXIDE PAINT NO. 4.—*Analysis of Pigment.*

	Per Cent.
Alumina	3.50
Calcium	1.07
Iron oxide	92.00
Silica	0.82
Loss on ignition	2.55
	99.94
Pigment	57.66
Vehicle	43.44
Specific gravity of vehicle at 60°	0.9450

GREEN HOLDER PAINT NO. 1.—*Analysis of Pigment.*

	Per Cent.
Soluble alumina, Al_2O	2.94
Barium sulphate, $BaSO_4$	40.62
Calcium sulphate, $CaSO_4$	18.55
Combined water, H_2O	2.68
Insoluble silica, SiO_2, and alumina, Al_2O_3 (clay)	11.98
Lead chromate, $PbCrO_4$	9.49
Prussian blue, $Fe_7(CN)_{18}$	13.45
Undetermined	0.29

Analysis of Vehicle.

Acid number	5.48
Iodine number	162.0
Linseed oil	88.54
Rosin oil	Present
Saponification number	198.7
Turpentine	11.46
Unsaponifiable number	2.16
Specific gravity	0.9246

GREEN HOLDER PAINT NO. 2.—*Analysis of Pigment.*

	Per Cent.
Alumina	1.94
Calcium carbonate	1.22
Chromic oxide	43.42
Ferric oxide	1.78
Insoluble matter	8.70
Lead chromate	40.43
Moisture	1.04
Nickel oxide and magnesia	Trace
Zinc oxide	0.73
	99.26
Pigment	63.57
Vehicle	36.43
	100.00
Specific gravity of vehicle at 60° F.	0.9532

Application of Paint.—The most important item in applying preservative coatings to metal is to have the surface thoroughly cleaned and free from moisture. The next is to have the paint

film of sufficent thickness to assure a good wearing body, and not sufficiently thick to cause crinkling, creeping or cracking. The latter can be accomplished by the employment of experienced painters, under competent direction. No painting should, of course, be done in damp or freezing weather, not late in the day or early in the morning. There is but one way to paint a guide frame, that is from swinging scaffolds. The type of scaffold to use is one having a guard rail completely enclosing the men. Such a rail is easily applied to the ordinary painting scaffold. Many safety blocks are on the market; some released by shifting the fall from a spiral groove to the regular groove on the other side of the sheave; others released by tension on a line attached to the upper block. Many engineers oppose the use of any of these types of blocks, fearing that the strands of the rope may be damaged by the retaining mechanism. Look carefully into this matter, as improvements are constantly being made in such devices.

There are two methods of painting the sections of a holder, both used extensively and having strong adherents. One of these is to keep the holder at its normal duty, and paint the entire surface from swinging scaffolds. The other is to lower the holder until the upper sheets of the inner section are accessible from the tank walk, applying the paint as the holder rises. An objection to this method, although cheaper than the former; is that there is danger of painting the sheets before they are thoroughly dry. This objection is overcome by one large company by mounting the painters on trestles on the tank walk, thus making them paint several sheets above the water, giving more time for the drying of sheets before painting.

A painting gang should include a foreman for every 10 painters. They can be conveniently divided into a scaffold gang; a gang for cleaning out, scraping and red-leading cups; a gang for painting carriages, goosenecks, etc., and places difficult of access. Each one of these groups should be under a foreman or sub-foreman; and another competant man should be detailed for mixing, preparing, and issuing paint, supplies, brushes, etc., in order that the foreman's time may not be taken from the main work.

In painting steel tanks, care should be taken that it is not done when the air is warmer than the tank water, as the surface of the plates will be damp and the paint will not adhere to the metal. It is the writer's observation that in this climate the water in the tank does not take the temperature of the air before the first or middle of August, after which time tanks can be painted with safety. The brushes found most convenient for holder work are shown in Fig. 13.

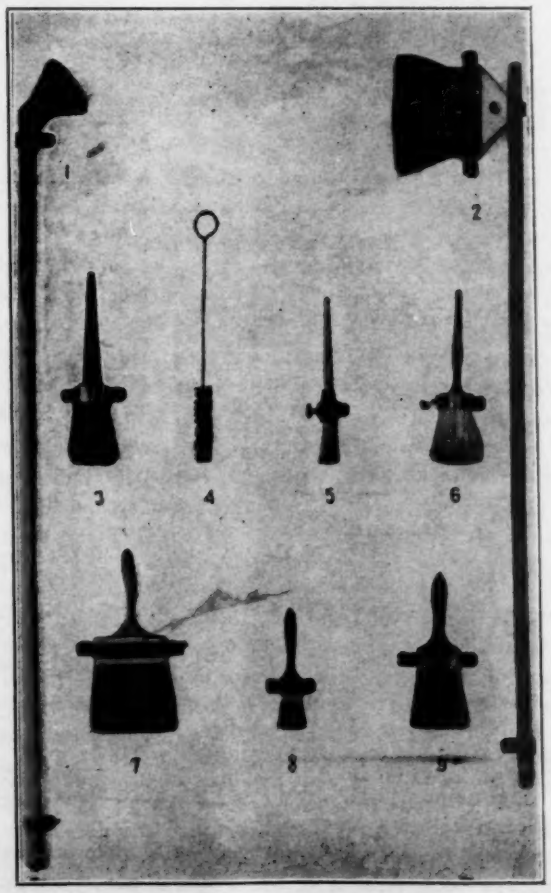


Fig. 13.—Brushes for Holding Painting.

No. 1. Long Handle Tar Brush.—For painting cups and pockets in frame work, and bottom of carriages.
No. 2. 3-Knot Roof Brush.—For painting crown.
No. 3. No. 225 Round Brush.—For painting frame work.
No. 4. 1¼-Inch by 5-Inch Wire Handle Brush.—For narrow and deep pockets.
No. 5. No. 6 Stencil Brush.—For stenciling scale on holder.
No. 6. No. 2 Painter's Duster.
No. 7. 5-Inch Wall Brush.—For painting shell and frame work.
No. 8. 1½-Inch Brush, Set in Rubber.—For ends of lattice bars in column supports, etc.
No. 9. 3-Inch Brush, Set in Rubber.—For carriages and wheels.

Heating by Steam.

The writer is advised that in parts of Europe, where the temperature ranges are as low, or lower than here, nothing is done to prevent water seals and tanks from freezing, and no damage occurs. However, as we have not reached such a degree of temerity, current practice regarding the warming of water in seals and tanks will be discussed. As a general rule, on installing steam piping upon the holder, there should be ample provision for expansion and contraction, and no part of the frame work, railings, etc., be touched by or enclosed in pipe covering.

Main Lines.—There are two methods of installing the main steam lines to holders—underground and overhead. The advocates of the underground claim less damage to steam covering from weather conditions, and more sightly appearance of the holder structure. Another point in their favor, if laid below the frost line, is freedom from freezing when the lines are not in use and presumably shut off.

If underground lines are used, the following method of covering them has given good service: First, a regular magnesia, asbestos, or air cell sectional covering, over which is a wrapping of ¾-inch hairfelt, which in turn is protected by builders' paper or tar paper, the whole enclosed in canvas covering, with the seam on the bottom. Forms are then constructed, allowing several inches of space around the covered pipe and the forms filled with concrete. Expansion is provided for by uncovered loops or bends enclosed in waterproof pits filled with sawdust, ground asbestos, or other insulating material which will allow movement of the bend. The pipe will move freely inside of the covering without destroying the concrete envelope. The valves on these lines should be inside a building, and pitch should be toward the building, in order that no drains and steam traps underground may be necessary. However, a trap receiver and steam trap can be located conveniently in the pipe tunnel, directly under the valve-house floor. As condensation will be heavy during cold weather, whether underground or overhead, trouble has been experienced with steam traps subjected to such constant duty. The writer has used the receiver and trap shown in Fig. 14, with good results.

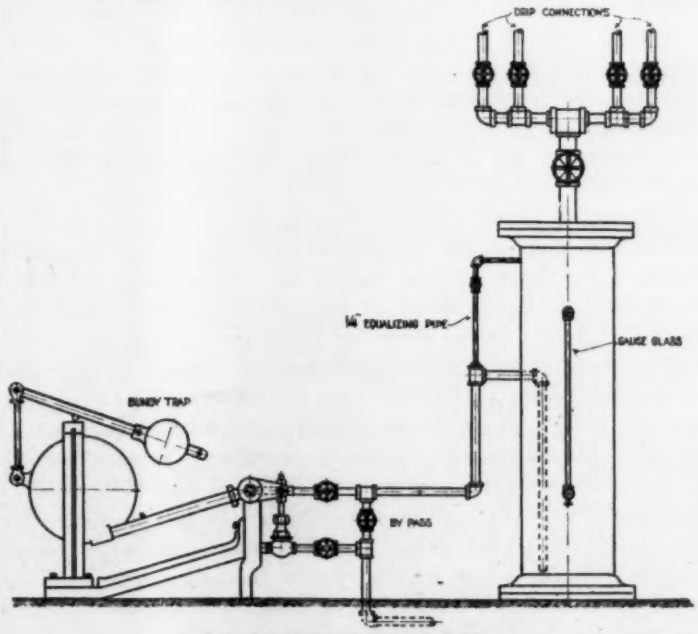


Fig. 14.—Steam Trap and Receiver.

This combination of trap and receiver was devised to overcome the constant dumping of the trap, with constant wearing of its

(*Continued on page 378.*)

THE AMERICAN GAS LIGHT JOURNAL INC.

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NEW YORK, MONDAY, DECEMBER 14, 1914.

BRIEFLY TOLD.

CALLING DOWN THE ALARMISTS.—In the issue of the "Literary Digest" for November 7th, there was an article on "Gas Poisining—A Cold-Weather Peril," evidently written by an M. D. with little knowledge of the subject and no experience, but in a way calculated to frighten the lay-reader. The President of the "Institute" has written to the publishers of the "Digest," calling attention to misstatements in the article, some of which we quote.

"In answer to the statement 'That a very tiny leak in a gas pipe might suffice to liberate enough carbon-monoxide in the course of months to affect disastrously the health of every member of a family': Fortunately, all illuminating gas contains enough aromatic hydro-carbons to cause a noxious odor, which gives timely warning, and would be unbearable long before there is enough carbon-monoxide in the atmosphere to do any harm.

"The writer also speaks of the production of carbon-monoxide during the imperfect combustion of gas. Wherever a defective burner is producing even a minute quantity of carbon-monoxide, it is, by the same process, throwing off enough acetylene with an odor of garlic to warn a cook who persists in having all of his dishes 'Bordelaise.'

"The writer says: 'The badly managed hot air furnaces and fissures in the pipes of chimneys are dangerous.' If this were strictly true there would be no living inhabitants in such cities as Pittsburgh and London. Strange to say the workmen in gas manufacturing establishments and the distributing departments of gas companies are among the healthiest people in the world, and live to ripe old ages; and in 39 years' experience I have never heard of any effects of slow gas poisoning, spoken of in the article.

"The writer enumerated in the list of 'Dangers to Health,' illuminating gas, heating gas, coal stoves, flue gas and defective chimneys; but has overlooked one very serious generator of carbon monoxide, i. e., the smoking of tobacco. In 1900 I found that ordinary tobacco smoke contained a large percentage of carbon monoxide; and to bring experiments down to date and verify them, I have analyzed the smoke of tobacco burned in various ways. The smoke of a high grade Havana cigar contained 7.20 per cent. of carbon monoxide, that of a smaller domestic cigar showed 4.00 per cent., that from an ordinary cigarette, such as we roll in California, contained 1.6 per cent. of carbon-monoxide, and smoke from a losely filled pipe 0.6 per cent. Thus it is shown, that while a medical man goes far afield hunting for a deleterious gas which he claims to be fatal to 'men, dogs or cats,' in quantities of ½ to 1 per cent. he may be writing his conclusions while smoking a cigar which generates as much as 7.2 per cent. of carbon-monoxide and subject the members of his family to 'oxycarbonism."

President Jones shows himself alert, as always, and he, as the head of the gas fraternity, was the right man to voice the protest.

SOCIETY OF GAS LIGHTING.—The annual meeting of the Society of Gas Lighting was held at the Hotel Astor, New York city, on Thursday evening last; Colonel F. S. Benson presiding, and some 30 members attending.

The election of officers for the ensuing year resulted as follows:

President—Colonel F. S. Benson.
Vice-President—Alexander H. Strecker.
Treasurer.—W. Cullen Morris.
Secretary—George G. Ramsdell.
Member of Executive Committee—William H. Bradley.
Finance Committee—Charles H. Nettleton, W. J. Walsh, W. F. Lawrence.

The usual dinner followed the business session.

PROGRESS CLUB.—The annual dinner of the Progress Club of the Brooklyn (N. Y.) Union Gas Company was held at Acme Hall on the evening of Thursday, the 10th. More than 150 members and guests attended, and all enjoyed the banquet and entertainment. Those at the guests' table with President J. L. Llewellyn were: George A. Saunders, T. M. Ambler, Theodore Haight, F. S. Benson, Jr., George M. Kirchmer, F. R. Wogan, Thomas Payne, G. W. Gatehouse, George J. Mahr, S. K. Campbell, John M. Brock, L. S. Stiles, R. W. Bush, F. B. Jourdan, A. F. Staniford, J. H. Jourdan, and H. S. Vining. Good singing by caberet artists added to the merriment. Brief remarks were made by President Llewellyn, A. F. Staniford, J. M. Brock, F. W. Bush, G. A. Saunders, S. K. Campbell, L. S. Stiles, and G. M. Kirchmer. Mr. Staniford gave high praise to the club for the work it had done, and praised the entire force of the company for its loyalty and faithfulness. The other speakers dwelt upon the educational value of the organization, and some told good stories.

NEW YORK SECTION ILLUMINATING ENGINEERING SOCIETY.—"Art and Science in Home Lighting," was the title of the paper read by Mr. G. W. Cassidy at the December meeting of the New York Section I. E. S., on Thursday evening. There was more commonsense than anything else in what he said, and more encouragement in the fixtures displayed than is generally found in discussions of this subject. The paper was replete with practical suggestions on ways and means of obtaining color and diffusion. The display comprised 12 gas and 5 electric fixtures; the excellent display of gas fixtures being made possible by the co-operation of Mr. H. B. McLean, President of the National Commercial Gas Association, assisted by Mr. Thomas. Schofield, and included beautiful and effective designs by Messrs, Bayley & Sons and the Welsbach Company.

Chairman Macbeth discussed the paper, as also did Messrs. Powell, Lukiesh, Calvert, Porter, Hunter and Stickney. The meeting and the informal dinner which preceded it was well attended, among those present being A. R. Burr, of New Haven; L. H. Scherck, of Poughkeepsie; A. R. Beal of Newburg, and J. W. Young, Assistant Engineer Light and Power, City of New York.

The monthly Council Meeting of the Society, held during the afternoon, was attended by President McAllister and Messrs. P. S. Millar, G. A. Hoadley, E. M. Alger, H. Calvert, W. C. Morris, A. S. Miller, G. H. Stickney, L. B. Marks, C. O. Bond. C. A. B. Halverson, H. H. Magdsick and M. Lukiesh.

INSTITUTE DIRECTORS MEETING.—The first Directors meeting of the new administration was held at the Society's headquarters, Thursday morning, Dec. 10, at which time a large number of routine matters were disposed of and plans for next year's work were outlined. In the absence of President Jones, Vice-President Walton Forstall presided. The directors present were Messrs. Alfred Forstall, J. B. Klumpp, C. H. Nettleton, W. S. Blauvelt and Geo. G. Ramsdell, Secretary.

No definite announcements are yet ready as to the personell of the numerous committees or of the activities which will receive the greatest share of attention next year.

MINNEAPOLIS CONVENTION.

REPORT OF CLOSING DAYS.

The final sessions were marked by the same interest which had characterized the meeting throughout.

Friday Session.—President Young called first upon Mr. H. O. Loebell, who reported on The Development of Industrial Fuel; and then, owing to the absence of Mr. Frank W. Freauff, Mr. W. H. Gardiner read the Report on Differential Rates. Like all contributions from the Doherty organization, this proved all-absorbing. It was discussed by Messrs. Hewitt, James, Wrightington, Ambler and Barnitz, and so many important considerations were involved that it was voted to hold the report over until it could be discussed more thoroughly and at length.

Reports of the following committees were then presented: Central Development Bureau, by R. C. Ware; Motion Pictures, by W. J. Clark; Manufacturers' Committee, by C. V. Roberts, and Commercial Advancement, by Arthur Hewitt. That these papers were not discussed was due to lack of time, not to lack of interest.

Owing to the length of the program and the time taken by discussions, three very important topics were not even brought to the attention of the meeting. These were the Reports of the Committees on Indoor Lighting, on Outdoor Lighting and Educational Control. Lighting is too important a subject to be passed over in this manner, and a National convention on this topic alone would bring far more beneficial results than on any other single topic. The question of Education as far as the Association is concerned has been given sufficient publicity and is determined for the next three years so this omission is not so unfortunate.

The closing scene of the meeting will be remembered for the warm and sincere praise which Mr. Arthur Hewitt gave the President and his associates. Mr. Young responded with his accustomed modesty, and then declared the Convention adjourned.

Industrial Fuel Sessions.—The afternoon session of Wednesday was attended by about 50, and their seriousness was shown by their staying until 6:30 P.M.

The first paper read, "High Temperatures and Artificial Gas," by E. Raven Rosen-Baum, was a masterly presentation of the recent development of the Oxy-Illuminating gas torch; the principles involved; and describing cutting steel, welding cast iron up to 1½-inch section, welding aluminum, brazing very delicate work, brazing brass-bed tubes, lead burning, etc., all commercially possible with this fuel device. A study of this paper by both commercial men and engineering staffs of the gas fraternity is well worth while.

Mr. R. P. Brown presented a paper on the "Control of Gas Temperature in the Heat Treatment of Steel," in which he drew attention to the necessity of selling an electric pyrometer as a part of gas furnace equipment, particularly on high temperature work.

"Brass Melting in Gas Fired Crucible Furnaces," by E. F. Davis and C. E. Chapple, evoked wide interest and discussion; and was followed by a recital by F. R. Hutchinson, of experiences in brass melting with natural gas. The exchange of experiences and ideas on this subject should do much to further develop the sale of gas to brass founders.

The paper on the "Carbona Process of Metal Coating," by Mr. B. B. Yeomans, led to the request that the subject of "Metal Finishes" be covered as completely as possible by papers for the next convention. The last paper of the day was on a subject uppermost in the minds of most commercial men to-day, "Gas Fired Steam Boilers," by C. E. Chapple. It set forth the characteristics to exact in selecting the boiler to be sold, the kind of man to obtain or develop the sale, and the importance of determining the proper size of boiler for the work intended. The paper was a presentation of facts acquiesced in by most of those present.

Thursday's Sessions.—Those attending these discussions to-day were mainly industrial fuel men and men handling hotel appliances. About 70 were present.

The first paper read, that by Mr. L. Gaston, on "Campaigns," was received with much interest. The concensus of opinion was that industrial gas should be better advertised, the advertising to be of a nature that would convince the consumer that the gas man really had something good to offer, and knew enough about the consumer's business to prove it.

Mr. H. D. Gillingham's paper on "Hotel and Restaurant Ranges" emphasized the importance of looking after the gas-oven business in this field, the reel oven in particular.

Mr. J. H. Walker, gave an interesting talk on the "Syphon-Blast Range;" why it was originally developed by him, and the kind of work it covers, and promised to submit to the Association for publication data on coal *vs.* gas in 14 installations, covering all phases of the preparation of meals at wholesale. A decided difference of opinion developed as to the desirability of the different types of syphon-blast ranges. In San Francisco they use the Lang type of range exclusively, and get good results; but this is in competition with $11 coal. It seemed from the discussion that much gas business was obtainable in institutions, and should be more energetically sought.

Mr. Russell Sard presented a paper on "The Surface Combustion Broiler," and precipitated a lively discussion which extended well into the afternoon. There was some question as to whether the type of burner just developed for the new Rathburn-Sard table top broiler really gives surface combustion, which discussion did not clear up to the satisfaction of all participating. Mr. G. W. McKee gave a talk on various types of burners and their functions, which was amplified by Messrs. Zanders and Tully Willson.

A paper on "Gas Fired Smoke Houses," by W. L. Hudson, followed. and it soon developed that this is a most important subject at present, particularly to the packers. The experiences of the Chicago and Milwaukee companies were described and much valuable information given.

The last paper of the session, also by Mr. Hudson, was a continuation of the previous subject, covering auxiliary packing and provision house appliances, and the probable revenue obtained from them.

Before the session closed mention was made by Mr. Chapple that an experimental oven of the positive-indirect heated type used in japanning was being made in Brooklyn, N. Y., for the Laclede Gas Light Company of St. Louis, to be used for bread baking on a large scale. Mr. Chas. Gehnrich stated that the oven was being built at the request of the United Bakers' Association, of St. Louis. The results of this installation will be watched with interest as much may come from it.

The best show, the smallest attendance, the largest number of papers and reports, and the longest sessions were some features which marked the Convention.

Too much cannot be said in praise of the work of Mr. L. F. Blyler in planning and housing the show and in caring for the thousand-and-one details which eliminate friction and annoyance for the exhibitors. The election results give the manufacturers a good representation on the official roster, and their advice will be most valuable when the question of a show at Washington is discussed.

National Civic Federation.

"Government Ownership" was again one of the topics of the National Civic Federation at its fifteenth annual meeting, held at Hotel Astor, New York City, December 4th and 5th.

Although one whole afternoon was given to this subject, and one-quarter of the time taken up by all the sessions, it was overshadowed by "National Defence" as a topic; and the session was marked by a mere handful in attendance and the mediocre quality of the papers. These were partisan in spirit, and contained so many statements open to question that little progress can be looked for as a result of the meeting. Fortunately, the great work of examination and analysis which has marked the efforts of the Federation will not be impaired by the political "rhetoric" of Representative Lewis and Commissioner of Immigration Howe, who took the affirmative, nor by the thunders of doubt hurled by plain Mr. Gordon and modest Mr. Sullivan. The important issues surrounding municipal ownership cannot be settled by debate if they are to be decided on their merits, and the waning interest in those features which affect gas companies indicates that service will be the deciding factor as far as they are concerned.

(*Continued from page 375.*)

The Care and Maintenance of Gas Holders.

working parts. The type of trap shown is particularly valuable for the service because its condition can be determined at any time by casual inspection.

The receiver is a piece of 12-inch standard pipe, 4 feet long, with 12-inch extra heavy flanges. The drips connect to a manifold connected to the receiver. A valve is put in this line so that repairs, etc., may be made. The discharge line is tapped into the receiver, 2 feet 6 inches from the bottom. By connecting the pipe at this point, about 65 per cent. of the volume of the receiver is available for storage, and the remainder is additional capacity in case large quantities of condensation have to be disposed of instantly. A gauge glass is installed on the receiver, by which it can be ascertained if the system is functioning properly. The discharge line extends to within ½ inch of the bottom. A ¼-inch equilizing pipe connects the discharge line to the receiver. Without this pipe the trap would dump when the lower end of the discharge line becomes sealed in the condensation.

Notwithstanding the arguments of advocates of underground steam piping, the most convenient and economical way is to keep steam lines overhead and accessible at all times. The writer's practice has been to carry the main feed line for the holder inside a building, as far as possible, and across the intervening space, supported by truss rods or hangers. Horizontal lines on the holder are hung from the standards and diagonal braces, leaving the pipe free to take up the expansion and contraction. The covering of these overhead lines is the same as described for underground work, except the concrete. This gives adequate protection, and very little damage has occurred from snow, certainly not sufficient to warrant placing the lines underground, were this the only reason.

Risers.—There are two ways of installing risers for the various cups.

The first method is to erect a single riser of sufficient size to supply all the cups, reducing it in size as the various branches are taken off. This makes a very neat and inconspicuous installation and is cheaper to erect, the objection to it being the necessity of shutting off all the cups above a break, and the increased danger of syphoning the upper cups into the ones below in case of accidental shutting off of steam or careless handling of the valves. The writer prefers a separate riser for each cup, covered separately. The controlling manifold for such a riser system is illustrated in Fig. 15.

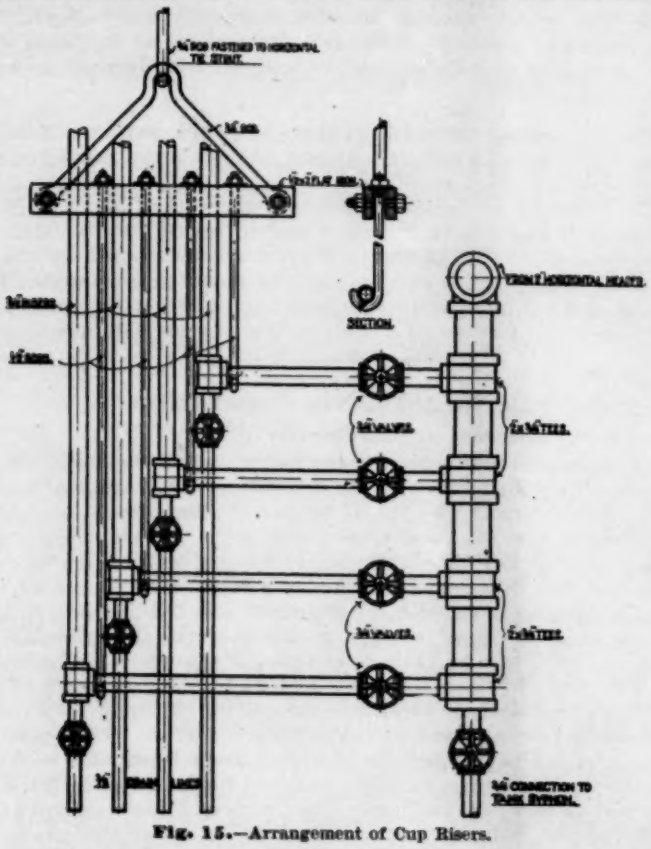


Fig. 15.—Arrangement of Cup Risers.

The suspender rods carry the weight of the riser, and prevent the breaking of the horizontal nipple at the base, and provide separate adjustment for each riser.

Steam Hose.—The advantages of metallic hose over rubber are as follows:

1. Greater strength.
2. Consequently, less liability of freezing or syphoning cups by reason of broken hose.
3. Less loss by radiation, as more effective insulating covering can be applied to metallic hose, without it becoming unwieldly.
4. Longer life.

The length of time which metallic hose will last is still an open question, but that purchased within the last 3 or 4 years is still in service and shows no signs of failure. Its disadvantages as compared with rubber, are:

1. Greater difficulty in repairing when breaks occur.
2. Greater liability of injury through careless handling, such as crushing, bending too short, etc.
3. Higb first cost and maintenance.
4. Greater weight.

The woven covering on this type of hose requires replacing about every second year, at a cost about equivalent to new rubber hose. This makes it necessary for the metallic hose to last a considerable period, in order to make it cheaper to use than rubber hose. The probable advantage from the use of metallic hose to date is increased security against freezing or syphoning cups, and reduced labor repairing constantly breaking rubber hose.

Tank and Cup Jets.—After a number of season's experiences with syphon jets, the writer is of the opinion that they are very much more economical of steam than the plain jet discharging live steam directly into the water. They are also practically noiseless, no objectionable cracking and hammering like the old open jets. The syphon jet does not seem to have the same range of adjustment as the plain jet, and in very severe weather cups require closer watching. With tank jets it is the practice of some engineers to draw the cold water from the bottom, discharging at half depth, and with alternate jets draw from half depth and discharge at surface.

During the past winter, it was the writer's observation that considerable diffculty was experienced, due to the necessity of quickly putting into service additional risers, during very severe weather, on holders which were equipped entirely with the syphon type of jet. We finally resorted to the expedient of placing a live steam jet in conjunction with each syphon jet, and when the temperature dropped below zero we turned on these additional jets, obviating the necessity of extra risers.

The table given here is largely the result of the writer's experience. The boiler horse-power given for 3,000,000 and 10,000,000 cubic feet holders, is an average, there being times when requirements are considerably greater,. The figures for the 3,000,000 cubic foot holder are from measurements with a steam flow meter, and for the 10,000,000 cubic foot holder, the actual evaporation was taken.

Heating by Hot Water.—In many instances where hot water is used in tank and cups, local conditions make large volumes of hot water available. In one instance the condenser discharge from large turbine units leads to a 5,000,000 cubic foot holder tank, the supply to the condensers being taken from the bottom of the holder tank, hot water being in sufficient volume to preclude the necessity of using steam on the holder, except on upper cups in very cold weather. Possibly the most common instance where hot water can be economically used is that of isolated steam driven distributing stations, where there is a large volume of exhaust steam. One such installation is under the charge of the writer, and has worked satisfactorily so far. The installation shown in Fig. 16 is used with two 5,000,000 cubic foot, 5 section, steel tank holders. The total engine capacity being about 1,100-horse power. The economy of such a system depends upon the quantity of exhaust steam available, the distance the hot water must be moved, the type of holders, condition of cups and tanks as to the possibility of good circulation, the character of the holder water (whether clean or otherwise). The aparatus and piping used in this installation follows:

1,000 horse-power Open Type Heater.
2-10 x 6 x 12-inch Single Acting Pumps.
8-inch Back Pressure Valve.
10-inch Exhaust Steam Inlet.
4-inch Cold Water Inlet.
4-inch Hot Water Discharge.

Exhaust steam from the engines passes through the closed heater, *A* (which was already in use at time of installing open heater), and from there into the open heater, *B*. If necessary, the closed heater may be by-passed through line *C*. A back pressure valve, *D*, is in-

Data on Holder Heating.

Tank,	Sections.	Capacity of Holder (Cubic Feet).	Number of Jets.		Type and Size of Jets.				Average Boiler Horse Power.	Size of Feeds.	
			Tank.	Cup.	Tank.	Size (Inches).	Cups.	Size (Inches).		Hor. Headers (Inches).	Risers (Inches).
Steel.....	3	500,000	1	1	Syphon	¾	Syphon	¾	....	1	¾
Brick.....	2	1,000,000	..	1	.....	...	Syphon	¾	....	2	¾
Steel.....	3	1,500,000	1	1	Syphon	1¼	Syphon	1	....	2	¾
Steel.....	4	3,000,000	2	1	Syphon	1¼	Syphon	1¼	38.0	2	¾
Steel.....	5	5,000.000	2	1	Syphon	1¼	Syphon	1¼	....	2	¾
Steel.....	5	10,000,000	2	2	Syphon	1¼	Syphon	1¼	80.0	2	¾

Spare risers are provided on the larger holders, but the necessity for their use has been so infrequent that the abeve figures can be said to fairly represent average conditions.

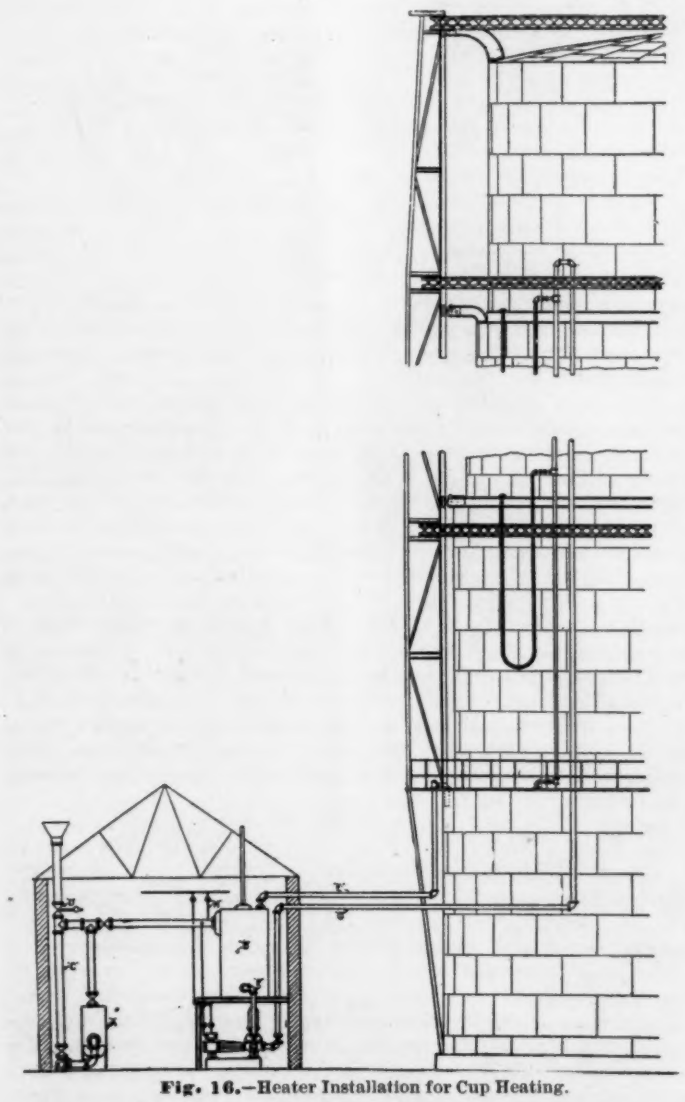


Fig. 16.—Heater Installation for Cup Heating.

serted in the outboard exhaust, set to open at about 3 pounds. Heater *B* is supplied with cold water from line *E*, which syphons its supply from holder tank, as shown. The cold water from the holder tank, heated by the exhaust steam, is discharged by the pumps into the riser, *G*.

The riser, *G*, is carried up above the highest cup, and the cup connections are made to the return line, as shown. The object of this is to provide a uniform supply of water to all cups. If a single riser is used, the lower cups will rob the upper ones, unless the valves are throttled to such an extent that they are easily obstructed by foreign matter in the water. The return riser terminates in the tank syphon, which is used only in severe weather, as it has been found that the tank water receives sufficient heat from the overflow of the cups. If, at any time, sufficient steam is not available to keep the water issuing from the open heater at 210°, high pressure steam may be admitted into the heater through line *H*. The cold water supply line, *E*, should have an indicating thermometer, and the pump discharge, *G*, a pressure gauge and recording thermometer. The pumps should have stroke counters and pump regulators. This system has shown a marked economy over high pressure steam.

Skimmers.—It does not seem necessary to give any considerable space to skimmers. Their operation is simple. It might be well, however, to point out the necessity of keeping the surface of the tank water as free from oil as possible, as those of the older type, without dam sheets, are apt to throw oil on the outer surface of the tank and cup water, and the action of gas condensate upon paint is extremely destructive, and one of the contributing factors to corrosion of cup and grip sheets at the water line.

Snow Cleaning.—The organization of a force necessary to keep holders cleared of snow is governed by local conditions. The practice in a number of the larger companies appears to be as follows:

The responsibility for having the requisite number of men on hand to keep the holders at any station free from snow, is imposed upon foremen, generally attached to the street department. They have addresses of a sufficient number of men to do the work, and upon the start of a snow storm, they get in touch with the superintendent or general foreman by telephone; and upon being instructed that shoveling will likely be necessary, they gather their men and proceed at once to the locality assigned them. Some companies pay snow shovelers an extra rate of wages, and also guarantee them a certain number of hours when turned out. It is also well, where stations are located at remote points, to keep a supply of food on hand with facilities for properly preparing it in the case of necessity. It is also customary to have rubber boots for the snow shovelers, as it is difficult to get efficient work out of men who are cold and wet.

Care should be taken, when a snow gang is working aloft, to rope off or guard with red flags or lanterns, the zone in the street or yard into which the snow is likely to fall. It is also well to regulate the handling of snow so as to minimize damage to adjoining buildings, steam piping, hose, etc., as this, in such a winter as we have just experienced, may run into considerable expense.

Safety lines should be provided on all holders, whether equipped with guard rails or not, to be constantly in place during the winter season. On the majority of holders, provision will be found at the apex of the crown, either a perforated plate, or I-bolts, for attaching safety lines.

Before closing, a word as to improvements in design of recent holders, observed by the writer, in a holder frame having three sections and a capacity of 2,000,000 cubic feet.

Standard Supports.—The standard supports are constructed in the usual manner, with the front and back chords and struts, or stiffeners, formed of angles, the solid web plate projecting through the front chord.

The standard support is attached to the tank plates by means of angles, one leg fastened to the projection of the standard support web plate, and the other leg to the tank plates. The angles are of lengths somewhat shorter than the depth of tank plates, and are attached singly on alternate sides of the web plate, one angle to each course of tank plates. This eliminates the pockets so objectionable in the older Z-bar construction, and allows free access to all surfaces exposed to the atmosphere.

Standards.—The standards are formed of I beams 24 inches in depth in the lower tiers and reduced to 20 inches, 18 inches, and 15 inches on the top tiers. The method of forming connections where the size of I beams reduce is to cut a triangular piece from web of the larger size beam and draw in the back flange of this beam until its cross-section corresponds as nearly as possible with that of the beam in the tier above. The ends of the beams are faced, and when assembled form a close joint, the weight of the standards above being borne directly by the standard in the tier below, no weight coming upon the riveted connection. The guide rails are 12-inch I beams, riveted to the front flange of the I beams forming the standards, the rivets counter-sunk on the front face of guide-

rail. This wide I beam, in place of the usual guide rail, gives the standards lateral stability, and obviates the necessity for the horizontal tie struts seen on older types of holders.

Struts.—Struts are formed of pairs of 10-inch channels, spaced 6 inches back to back, with separators formed of 6-inch channels. At point of intersection of struts with standards, the structure is stayed laterally by triangular plates, one edge secured to the strut channel flanges, and the other to the web of I-beam forming standard, by means of angles. This method of construction eliminates the complicated angle iron lateral braces of the older type and very much simplifies the connection.

Diagonal Braces.—Diagonal braces are eye bars, pin connected at their points of intersection with struts and standards. The connecting pins have cast steel eccentric rings, which are adjusted at the time of erection to subject all of the diagonal members to equal strain. After adjustment is made, a key plate is inserted in a key way in the pin, and secured in position by a rivet through the web of the strut channel. The hole for this rivet is punched in the field, after the adjustment is made. The diagonal braces are not connected rigidly at their point of intersection in center of bays, but are held in position by a stirrup bolt.

Horizontal Tie Struts.—As noted, the horizontal tie struts, with their objectionable latticing or batten plates, are eliminated by the use of 12-inch I- beams on front chord of standards, in place of the usual narrow guide rail.

Caulking.—The edges of all connecting members, etc., are caulked to prevent the entrance of moisture.

Carriages.—The carriage and guide wheels of this holder do not show as marked improvement as the other members, as many improvements had already been made in the carriage. The designs show the carriages compact, with no inaccessible surfaces, and raised well off the sheets to insure proper draining. All wheels and rollers have grease cups.

Hand Rails.—Hand rails are solid round bars, supports being angles riveted to the stairways, grip channels, etc.

On another 1,250,000 cubic feet 3-lift holder, of recent construction, we find the guide frame free from lattice work, cover plates, and all enclosed sections, water pockets, etc.; horizontal tie struts being used, but with batten plates used in place of lattice bars.

The concrete guard wall is tied to the tank about 2 feet below top of wall by a 3 × 3 × 5/16-inch angle encircling the wall with rivets 4-inch C. to C., and outer leg punched every 6 inches for hairpin wire bonds into concrete. A groove 2 inches wide and 4 inches deep at top of wall is filled with 160° pitch.

Guide wheels have double web, joining flangs at outer edge with bearing surfaces faced. All bearings have grease cups.

Goose necks, were size warrants, have hand rails and ladders.

A gutter sheet of 7 by 1¼ inches is provided, extending above top curb of inner lift, with drains to throw water clear of holder.

Guard rails are 1-inch round steel and steel cable; supports are angles.

Cups have adjustable overflow to allow of lowering water for scaling and painting.

Additional ladders and platforms are installed to insure safety of those having to reach the cup heating equipment.

All surfaces of guide frame, cups and grips, if concealed after assembling, were sand blasted and put together with coat of red lead. All other parts of guide frame, goose necks and carriages were sandblasted in shop. The entire holder and tank were sandblasted after erection, followed immediately by a priming coat of red lead.

Report of Committee on Publicity, National Commercial Gas Association, R. C. Fowler, Co-Chairman.

Standards of Practice.

1. Function of Gas Advertising.—Advertising is the voice of the corporation. In the gas business it is used to mould public opinion, boost civic pride, aid good will, as insurance against agitation and competition, and to assist as nothing else can in the sale of goods and service.

2. Good Advertising.—Only that advertising is good, which judged by its results is a profitable investment rather than a more or less necessary expense.

3. Cost of Advertising.—It is fair to assume that all advertising of a public service corporation should result in increased business, and no advertising should cost more than a fair percentage of the profit on the increased business that it creates. Gas company advertising should never be asked to carry any charity account. When and where it becomes necessary to buy advertising that, by its nature promises no adequate returns, the cost thereof should be considered an extraordinary expense, and in no way be charged against new business accounts. It is better for a gas company to stay out of all "special editions," programs and miscellaneous "Good Will" mediums rather than to go into the few that are profitable.

4. Relation of Advertising to Sales Plan.—Advertising becomes useful only when it is a part of a well defined plan. No advertising should be done until a careful analysis is made which definitely determines the results desired and the steps which should be taken to gain it. If the advertising is to sell an appliance the following questions should first be answered in about the order named:

What will the appliance do?
Who are the prospects?
How many prospects are there?
What is the sales' plan?
How many appliances will the campaign attempt to sell?
What part of the appliance sales' profit, or increased revenue derived from the use of this appliance shall be used for advertising?
What medium or mediums shall be used?
How long will the campaign last?
When will the heaviest advertising be done?
What kind of copy shall be used?
What will be the nature of the appeal?
How will you attempt to check results?

Generally speaking, gas advertising is valuable in direct proportion to the co-operation it gives to, or gets from the selling force, and the securing of this co-operation is the vital element of any advertising plan.

5. Selection of Method.—Some methods are of much greater value than others, and in general it is better to make a considerable impression by doing most of your advertising by one or two methods rather than spreading it thin over the entire field. Gas bill stickers and window displays yield the largest returns for the small amount of money spent. Newspapers, booklets, circular letters, demonstrations, street cars, bill boards, house organs, lantern slides and novelties are of particular value depending upon the object in view.

Gas Bill Sticker.—It is usually better to use a sticker than to print your message on the face or back of the bill. It should be brief so as to be easily read, and it should stand out distinctly. Stickers are best used to advertise appliances, or convey a message of general interest. It is good practice to enable customers, by means of return post card stickers, to register complaints, order materials or ask for such special service as the gas company is seeking to render.

Windows.—The most successful gas window is one which shows only one kind of appliance, has one central idea and tells a simple story in the quickest and simplest way possible. A successful window is like a street car card or a bill board, in that it should tell its complete story at one glance. Neat condition, the upkeep of the display and a frequent change of display are vital considerations in the effectiveness of this type of advertising.

Newspapers.—The daily newspaper not only presents the greatest opportunity for advertising, but is also the most difficult medium to use successfully and the hardest in which to check results. The ideal way to use newspapers is to use a steady persistent appeal in small or fair sized copy, and to increase this to a big splash whenever you have a big story to tell. This secures accumulative effect and the large and small copy help each other to be more effective. Don't use space filling copy, rather keep out of newspapers until you have something definite to say.

Direct Advertising.—The success of any form of direct advertising depends very much on its distribution, and how closely it is related to the sales plan. Good straight-forward matter that gets the story across is all that is required. Cheap stuff is worse than useless, and too expensive matter is likely to create a wrong impression as to the profits of the corporation or the expense of using the appliance. We cannot too strongly emphasize the importance of a careful study of direct advertising in our business. The gas company has a unique opportunity in that it has a definite knowledge of conditions existing on the premises of its customers and prospective customers, and there consequently need be but a minimum of wasted advertising effort.

Street Cars and Bill Boards.—Street cars and bill boards are mediums of large and general distribution, and are most effective for general publicity in an extensive campaign, where they may form a very effective background for intensive work by some other form of direct advertising.

House Organs.—Company publications circulated to customers, are being used by several gas companies. To be effective, this form of advertising must be well done and is necessarily rather expensive when issued by any one company. The house organ has some unique advantages over other forms of advertising, but its chief fault lies in the uniformity of its dress and sameness of its apparel.

6. Distribution of Gas Advertising.—Distribution by meter readers and bill distributors is good practice, and in many cases men should be paid extra for this work to insure proper distribution. Distribution by meter readers is one of the most neglected opportunities of the gas campany. Where the list is not too large, of course mail distribution is best, and in practically all cases it pays to use a 2-cent stamp. Circular letter campaigns cannot be connected too closely with the sales campaign, nor can any advertiser know too much about his mailing list. Circutar letters to follow sales, not only greatly eliminate complaints but may be fully as effective sales helps as those sent out before the sale is made. Special booklets and folders prepared by the N. C. G. A. and appliance manufacturers are of great value, but they should always be used in connection with some form of follow-up by the local company.

7. Co-operation with Manufacturers.—The manufacturer of appliances, and the gas company who sells them, should meet on a common ground in the preparation and use of the matter prepared by the manufacturer and used by the gas company. Manufacturers should be encouraged to study the gas company's needs and desires in the preparation of advertising matter; and the gas company should use the matter properly and not be wasteful in its distribution. Manufacturers' list prices, subject to discount or change, should not be given in matter for gas company's distribution. Local sales prices should be used, imprinted for different companies.

8. Gas Trade Paper Publicity.—The Gas Trade papers render the industry very great service, and gas companies should recognize this service by giving the trade papers every opportunity to report on new work, or sales campaigns, and to publish papers and items of general interest. The N. C. G. A. Bulletin is also rendering a wonderful service to the industry and should be encouraged by all the co-operation possible.

9. Indirect Advertising.—Indirect advertising that is not misleading is especially good practice for the gas company. By this we mean the sale of premiums related to gas appliances, such as shovels to advertise coke, bread mixers to increase home baking, ironing boards with gas irons, etc. It is better practice to sell them at a bargain price than to give them away.

10. Exchange of Advertising Ideas.—The gas companies of the country should welcome and encourage all possible means of exchanging and benefiting by advertising ideas.

Recent Patent Issues.

Prepared for the American Gas Light Journal by Royal E. Burnham, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 20 cents.

1,118,095. Gas Producer and Compressor. E. A. Aumont, Paris, France.

1,118,319. Gas Generator. J. C. Walton, Fort Worth, Tex., assignor of one-half to John A. Wisherd, Stanton, Tex.

1,118,622. Gas Range. B. A. Baxter, Mansfield, O., assignor to New Method Stove Co., same place.

1,118,696. Bunsen Burner. L. J. Strause and O. Spahr, Philadelphia, Pa., assignor to Strause Gas Iron Co., same place.

1,118,921. Meter System. H. Chrisman, Edgewood Park, Pa.; assignor to Pittsburgh Meter Co., East Pittsburgh, Pa.

1,119,922. Metering Device. H. Chrisman, Edgewood Park, Pa.; assignor to Pittsburgh Meter Co., East Pittsburgh, Pa.

1,118,934. Globe Holder for Lamps. F. J. Humphrey, Kalamazoo, Mich.; assignor to General Gas Light Co., same place.

1,118,940. Method and Means for Gas Ignition. H. Lyon, Gloucester City, N. J.; assignor to Welsbach Light Co., same place.

1,118,941. Ignition Apparatus. H. Lyon, Gloucester City, N. J.; assignor to Welsbach Light Co., same place.

1,118,942. Ignition Device. H. Lyon, Glouscester City, N. J.; assignor to Welsbach Light Co., same place.

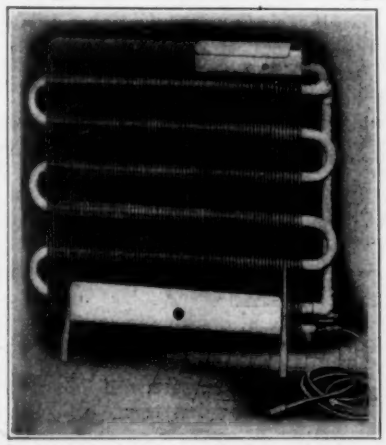
1,118,943. Gas Ignition Apparatus. H. Lyon, Gloucester City, N. J.; assignor to Welsbach Light Co., same place.

1,119,089. Packing Box for Globes. J. C. McMenamin, Philadelphia, Pa.; assignor to The Pennsylvania Globe Gas Light Co., same place.

New Methods and Appliances.

Gas Hot-Water Radiators.—This gas heated hot-water radiator with increased heating surface is being introduced by an eastern company.

The gas is burned in a bunsen type burner specially constructed for the work, and the flame is immediately beneath one length of the copper pipe of which the circulating coil is made. The sections of copper pipe have driven tightly upon them galvanized sheet metal fins to increase the surface exposed, close contact of the added surface aiding in the transmission of heat from the coil to the fins. The pipe sections are connected into a continuous coil by brass return bends. At the top of the coil there is an expansion tank, and at the bottom a drain cock. The radiator has one-eighth the weight of a cast-iron radiator, and also occupies considerable less space for the same amount of surface exposed. The radiator may be had with an ornamental screen covering.



Gas Heated Radiator with Copper Coil and Galvanized Steel Fins.

Illuminating Power of Kerosene Oil.—A bulletin of the Iowa Engineering Station, issued from the Iowa State College of Agriculture, by Wm. Kunerths, Asst. Professor of Physics and Illuminating Engineering, gives results of tests made to determine the quality of kerosene oil and relations between illuminating power and physical properties, so that the usefulness of an oil could be judged without a long burning test. The oils were burned in a small metal lamp with a No. 2 flat-wick burner and glass chimney, the wicks all of the same weight and $\frac{7}{8}$-inch wide. About ½ pint of oil was used in each test. Before testing a sample, a new wick was burned in it for 3 hours to reproduce service conditions. The amount of oil burned was determined by balance and stop watch. Candle power was measured on a photometer. Determinations were made with different flame heights, and the curve of candle power and illuminating power plotted. Because of the influence of atmospheric conditions, it was necessary to test a sample of one oil selected as standard whenever new specimens were tested. The term "illuminating power" used indicates the number of candle power hours per gallon of oil.

A greater flux of light was had from the cheaper oils, the average cost of 100 candle power hours running from 0.89 cent for a 10-cent oil to 1.97 for a 27-cent oil. These higher priced oils being from Eastern fields and having a lesser density. The heavier oils fogged the chimney more than the lighter oils, the low illuminating power of the latter being somewhat compensated for by lessening the labor of cleaning. Oils of low illuminating power charred the wicks most. No difference in the odor given off could be detected. The average density of the oils whose illuminating power was less than 1,100 cp.-hr. per gallon, was 0.801 gram. per c.c.; the average density of oils with an illuminating power above that figure was 0.818 gram. The oils of greater density also had a greater relative carbon content. All of the oils had a flash point above 100° F. The oils having high illuminating power had a high flash point, and vice versa, those below 1,100 cp.-hr. showing 110° average; and those above, 116° average. A range of over 50 per cent was found in viscosities, and the relation of viscosity to illuminating power was not very definite, although in general it appeared that the oils of high illuminating power were comparitively the more viscous. An increase in surface tension was in general accompanied by an increase in illuminating power. The cost of illumination from the samples tested was found to average 15 cents per 1,000 cp.-hr.; about the same as the cost of electric illumination with tungsten lamps having an efficiency of 1.25 watts per candle and current selling at 11.7 cents per kw.-hr.

Core for Babbitt.—In castings of babbitt metal it is often necessary to core out some of the parts. A very good core is made of salt and glue. Mix just enough glue into the salt to make a stiff paste, which is shaped or molded in a core box and allowed to harden. This kind of a core can be removed from the casting by soaking it in warm water.

Items of Interest
FROM VARIOUS LOCALITIES.

THE first meeting this season of the heads of departments of the Boston Consolidated Gas Company and allied concerns, at the Parker House, was attended by about 50. Vice-President W. A. Wood was in the chair. Papers on matters pertaining to the gas business was read by E. N. Wrightington, Second Vice-President; J. A. Gould, Engineer of Distribution; Albert Dunbar, Purchasing Agent; Capt. W. E. McKay, Vice-President of the New England Gas and Coke Company; H. H. Stimson, General Manager of the New England Coal and Coke Company; Charles Skentelbery of the Marine Department; Edward Page, Vice-President of the Federal Coal and Coke Company; N. W. Gifford, General Manager of the East Boston Gas Company; W. A. Learned, General Superintendent of the Newton & Watertown Gas Light Company, and W. B. Nichols, Assistant General Manager of the Citizens' Gas Light Company, of Quincy.

ON January 1st, Mr. J. P. Maxwell, formerly with the C. W. Hunt Company, and Improved Equipment Company, will enter the service of the Wm. M. Crane Company. Mr. Maxwell will travel in the Central West. Mr. Schutt retaining his territory east of Chicago. We congratulate both parties to the new arrangement.

IT is reported that the plant of the Storm Lake Gas Company, Storm Lake, Ia., was destroyed by fire on November 27th. The company is credited with 160 consumers in last year's reports.

MR. JAMES HARMON, who has held the position of Claim Agent for the United Gas and Electric Company, has been put at the head of the "safety first" work of the Middle West Utilities Company.

THE Sentinal Automatic Gas Appliance Company, of which Victor Tyler is President, is moving from New Haven, Conn., to Hamden. It is now employing about 50 hands, but it is said that it is sure to develop into a big industry. The company makes an automatic gas stove, controlled by a time clock mechanism.

THE Sussex (Del.) Gas Company is running a full force of men in Seaford, Laurel and Bridgeville, extending the service, although this time of the year is supposed to be the dull season. Many private houses, as well as manufacturing plants, now that the service can be relied upon, are being connected with the mains, and a number of miles of new mains are to be laid this year.

MR. E. E. EYSENBACH, general manager of the San Antonio Traction Company and of the San Antonio Gas and Electric Company, has resigned, and will remove to Tulsa, Okla., where he will look after extensive natural gas and oil interests which he owns in that State. Mr. Eysenbach has been connected with the San Antonio companies in the position of general manager for the last two years, coming from New Jersey, where he was connected with the Consolidated Gas Company. It was under his administration that the extensive program of improvements now in progress on the part of the public service corporations which he represented was begun and pushed successfully to its present advanced stage. These activities will now be continued under the direct supervision of Mr. W. B. Tuttle, vice-president of the companies, as no successor to Mr. Eysenbach has yet boen chosen.

ST. PETERSBURG (Fla.) householders are rejoicing in the use of gas, manufactured by the city at its new plant on Tenth street. Already there are about 200 houses connected, which means 600 to 700 separate meters, many of the houses being apartment buildings, and the city officiais are well pleased at the way people have begun patronizing the city's newest enterprise. Gas was turned into the mains for the first time November 30th, and there were many Sunday breakfasts cooked with gas. Mantel burners have been installed in the City Hall, where a demonstration of the lighting value of gas will be made. The commissioners plan to light the City Hall entirely with gas, keeping the electric installation for use in case of emergency.

THE Laclede Gas Light Company, St. Louis, Mo., announces a plan by which gas mantles and glassware on lights are insured against breakage. The corporation ventures into the insurance field on the conviction that the developments in the gas industry and in the manufacture of high grade mantles and glassware, will make the insurance plan a success. For 75 cents per lamp per year, the Laclede Gas Light Company will insure each light and keep it in working order and perfect repair. In effect they agree to respond to the customer's call, no matter how many times it may be during the year, and furnish labor and material necessary to keep the lamp in serviceable working condition.

THE Richmond (Va.) Real Estate Exchange has been fighting for two years to have the city ordinance which holds the property owner liable for gas bills contracted by the tenant, so modified that only the party who uses the gas shall be responsible. They say there has never been any just ground for imposing such a liability upon the property owner, and its enforcement has, in several instances, worked a hardship. Merely because the city owns the gas works, it is contended, is no reason why the city should impose an arbitrary condition on the property owner that would not be tolerated on the part of a public service corporation.

THE gas inspectors of the Canadian Inland Revenue Department found some remarkable conditions in some Canadian cities, according to the annual report of the department just issued. In regard to illuminating power 21 tests out of 23 in Victoria, B. C., showed the gas to be below the standard. In Winnipeg 75 out of 102 tests were below the standard, in Ottawa 26 out of 82 tests were the same. In Toronto, Montreal, St. John and the majority of the other cities and towns the gas was up to the standard for illuminating power.

THE complaints against the Worcester (Mass.) Gas Light Company, charging it with violation of the weights and measures law, preferred by the State commissioner of weights and measures, were dismissed in Central District Court. Francis H. Dewey, counsel for the company, maintained that coke in question had been sold legally, and that the statutes relating to the sale of coke by weight did not apply in the cases.

AS a token of its appreciation of her good work in recently bringing to the attention of the police, a man who misrepresented himself to be agent of the company, the Cambridge (Mass.) Gas Light Company presented a $10 check to Mrs. J. Robert Waugh.

WHEN any of the employees of the Milwaukee (Wis.) Coke and Gas Company and associated corporations bumps into a business problem that puzzles him he does not have to go to the boss for aid and advice; he simply takes his troubles to the Newport Efficiency Club, which solves the problems, not only for his benefit, but for the other members also. This club, organized last year by the office men of the several companies controlled by Mr. Ferdinand Schlesinger, meets every other Monday to talk shop and efficiency. It's object is the efficiency education of its members. Papers are read on business topics, and a general discussion follows. H. R. Sherman, of the office staff of the Harrow Springs Company, is president of the club. J. P. Janett, vice-president, and R. P. Fohey, secretary-treasurer.

BY suggestion of the Lighting Committee, the Tampa (Fla.) City Council has ordered the installation of ornamental gas lighting on the Bayshore Drive from South Rome avenue to the city limits. This is a continuation of the lighting as at present extending along the Suburb Beautiful.

THE North Adams (Mass.) Gas Light Company will furnish the illumination for the municipal Christmas tree in that city. Edward Hughes and John Heywood will have charge of the carol singing, and the Italian band will furnish music. Impersonations of the Three Wise Men, Angel Gabriel, and other Biblical characters, will be given by prominent people. The tree will remain standing from Christmas Eve to New Year's.

INVESTIGATION of the United Gas Improvement Company by agents of the Department of Justice has been virtually completed, and the reports are being scanned by department officials to determine whether a suit shall be begun under the Sherman anti-trust act.

SEASIDE HEIGHTS, N. J., expects that either the Ocean County Gas Company, of Toms River, will lay mains to it across the bridge; or else that the Coast Gas Company, of Belmar, which supplies Point Pleasant and Bay Head, will build a pipe line. In either case Seaside Park will benefit as well as Seaside Heights.

MR. CHARLES PSOTTA has moved from Pottsville, Pa., to Bethlehem, where he will be in charge of the office of the Allentown-Bethlehem Gas Company.

A WATER gas generator set of 350,000 feet capacity is being installed in Boulder, Col., by the Federal Gas Co., to supplement the output of the gas wells and to take care of the demand for gas should the wells fail entirely. Machinery from the Gas Machinery Co., Cleveland, O., has been unloaded and concrete foundations on which to place generators are ready. The generator set will be completed in about 3 weeks, according to Erector Rennert who is superintending the construction. This new equipment was ordered a month ago at the time of the failure of the gas well east of the city from collapsing casing. A force of men are now at work at the well erecting a rig, and as soon as completed expert drillers will be put to work cleaning out the bore to bring, if possible, a flow equal to former outputs.

MR. E. C. CAMPBELL, manager of the Benton Harbor-St. Joseph Gas and Fuel Company, was married on Thanksgiving eve to Miss Mary Newton, of Little Rock. Mr. Campbell is one of the newest residents of St. Joseph, and has made a distinctly favorable impression in the Michigan twin cities as a young man of personality and has won friends both in business and social circles.

THE Superintendents' Division of the Chattanooga (Tenn.) Manufacturers' Association at their last meeting heard a lecture on the manufacture of coke, by Mr. D. M. Rugg, superintendent of the Chattanooga Gas and Coal Products Company's plant in process of construction in Alton Park.

"E. N. T." SENDS this from Beacon, N. Y.: "The statement by Commissioner of Safety Cronin, after the report of the Public Service Commission's investigators into the lighting situation in this city had been made public, to the effect that a municipal lighting plant would be constructed by the city unless the Southern Dutchess Gas and Electric Company reduces its rates for electricity and gas, is laughed at by residents of Beacon. In the first place such a plant would cost $250,000, and the money would have to be appropriated by the taxpayers at a special election. Residents of Beacon are now groaning under the heavy load of taxes imposed upon them since the Cronin administration has been at the helm.

MR H. M. WALLACE, President of the Corpus Christi (Tex.) Gas Co., has filed with the Commissioners' Court of Nueces County an application for a franchise granting the company the right to extend its gas mains from Corpus Christi, along the highways, roads, streets and other placos of Neuces County, for the purpose of distributing and selling gas, either artificial or natural, to the people of Nueces County. Discussing the application that had been made by his company, Mr. Wallace said: "Our company had planned several months ago to build in some Texas city a gas plant similar to the plants at Corpus Christi and Waxahachie, now owned and operated by us. That decision has now been abandoned. Instead of spending money in building another plant we are going to spend the money in Nueces County. We will lay at least another 15 miles of gas mains in the streets of Corpus Christi, and if granted a franchise by the county, we intend at once laying mains in the section north of the present city limits, as well as in other parts of Nueces County.

THE City Councilmen of Indianapolis (Ind.) who are trying to have the Board of Public Works order extension of gas mains on streets within their councilmanic districts, have begun to study the gas situation for next year. The Citizens Gas Company is required to lay only about seven miles of new mains annually, and this amount had been ordered last year before several councilmen were aware that the board had taken action on scores of petitions. Profiting by their experience of last year, a few of the councilmen have expressed their intentions of filing gas-extension petitions before the board at its first meeting in the new year. J. D. Forrest, general manager of the gas company, advised the councilmen at a public hearing held recently to circulate gas-extension petitions early in the year, that the Board of Works might be able to give them proper consideration.

AT the annual meeting of the Philadelphia Claim Men's Association the election of officers resulted as follows: President, James B. Douglas, of the United Gas Improvement Company; First Vice-President, J. C. Rose, Pennsylvania Railroad Company; Second Vice-President, E. F. Nightingale, Employers Liability Assurance Corporation; Secretary, J. F. Conner, of the United Gas Improvement Company; Treasurer, W. H. Marshall, Travelers Insurance Company.

Utilities Commission News.

ASK REPRESENTATION ON BOARDS.—The delegates to the Boston Central Labor Union passed a resolution urging that the vacancy on the Massachusetts Gas and and Electric Light Commission should be filled by a practical electrical engineer, who is a member of organized labor. Another resolution urged that the place on the Board of Labor and Industries, which must be filled by an employee, should be from the ranks of organized labor.

COMMISSION'S ENGINEER TO CANVASS.—The Public Service Commission, First District, New York, has ordered its gas engineers to make a canvass of the Douglaston district in the Third Ward of Queens, to ascertain how many residents will take gas in case the mains of the New York and Queens County Gas Company are extended to that section. It is supplied with electric current, telephone and telegraph service, but has no gas. The complainants were unable to persuade the gas company to extend its mains, and applied to the Commission to compel it to do so.

The company's estimate of the cost of a distribution system to supply all houses in the Douglaston district is $86,731.69. The estimate of the Commissioner's engineer was $61,004.80. The commissioner says the company's estimate is too high, and that probably $70,000 or $75,000 would be ample and the work could be done for about $65,000 if certain isolated houses were omitted.

WEST SENECA (N. Y.) FRANCHISE.—The Up-State New York Public Service Commission has issued an order permitting extension of the lines for gas and electricity of the Depew & Lancaster Light, Power and Conduit Company through the town of West Seneca, outside of the city of Lackawanna. A number of hearings were held on this application, at which the Buffalo General Electric Company was the only objector. A stipulation has now been filed with the Commission, signed by both the petitioner and the Buffalo General Electric Company, in which the latter withdraws its opposition. The franchises are based on grants from the Town board of West Seneca and the Town superintendent of highways, and include permission for pole lines and wires, and for gas pipe lines.

VALUE OF GRAND RAPIDS ELECTRIC PLANT.—Upon petition of the city of Grand Rapids, Wis., the State Railroad Commission has fixed a price of $72,000 to be paid by the city for the property of the Grand Rapids Electric Company, which the city voted to acquire at a recent election. The present value of the property was given by the Commission as $63,500 and the cost of reproduction at $86,000.

EMPLOYERS' LIABILITY INSURANCE IN CALIFORNIA.—The manager of the compensation fund of the Industrial Accident Commission of California has issued a report, with a statement that, barring extraordinary calamity, those who hold State compensation insurance policies will receive a return premium of from 5 to 25 per cent. of the premiums paid, depending upon the experience in the various hazard groups. The California law requires that claim reserves equaling 72 per cent, of all earned premiums, less losses and loss expenses paid, be set aside, this reserve to be maintained for 5 years. It is thought that there is little possibility that losses and loss expenses will equal that percentage, and that the excess over actual claims can ultimately be dispensed with. This would indicate a further return premium to 1914 policy holders, after a fair catastrophe surplus is set aside.

The initial rates adopted for the coming year are the same as those charged by standard corporate companies, with the exception of the excess premium returns mentioned. All plants are inspected and the merit classification may result in rate reductions of 1 to 40 per cent. The statement issued covers the period from Jan. 1 to Oct. I. 1914, during which 5,360 applications for insurance were received and 2,478 accident cases handled. Expenses were 8.49 per cent. of the premiums. The totals are as follows: Appropriation (1913 statute), $100,000; premiums received, less premiums returned, $462,514; interest received, due and accrued, $4,503; total, $567,017; expenses and salaries, $41,329; compensation and statutory medical payments, $52,528; outstanding cost, foregoing item, $110,456; unearned premiums, $138,684; surplus, $224,020.

OHIO ACCOUNTING.—The Ohio commission is arranging to put its new accounting system into operation on Jan. 1, and it is believed that the adoption of uniform accounts will give a broader insight into business than has been possible in the past. There is some uncertainty in regard to the fate of the Public Utilities Commission under the administration of Governor-elect Willis. In some quarters it is believed that the commission will be reorganized under another name, with a Republican majority.

Financial Notes.

A REDUCTION in the quarterly dividend on Standard Gas and Electric preferred stock from 2 to 1 per cent. is announced. The company's net income for the 12 months ended October 31, after payment of all charges, was equivalent to only 5.3 per cent. on the $11,784,000 preferred stock, which is entitled to 8 per cent. cumulative dividends per annum. Since September, 1913, the dividends have been paid in scrip bearing 6 per cent. interest. The company is the largest of the enterprises controlled by H. M. Byllesby & Co., of Chicago. A statement issued by the company says it has been impossible owing to the depressed financial conditions to complete a form of permanent financing which provided for the retirement of the remaining balance of $2,250,000 collateral trust 6 per cent. serial notes and other bills which, less current assets, amounted to $232,112.

THE Public Service Gas Company has filed a certificate showing that Nov. 30 it issued $750,000 of the capital stock and received cash for the full amount of the issue. The Public Service Electric Company also has filed a certificate of the issue of $2,000,000 of the same date, for which it also received the par value in cash. Both companies are subsidiaries of the Public Service Corporation of New Jersey, and the stocks were issued to the holding company.

ANNOUNCEMENT is made that the property of the Eau Claire Gas Light Company, which has been controlled for some time by the American Public Utilities Company, of Grand Rapids, Mich., has been transferred to the Wisconsin-Minnesota Light and Power Company, also controlled by the American Public Utilities Co. The Wisconsin-Minnesota Light and Power Company has also acquired the property of the Red Wing Gas Light and Power Company, the Minnesota-Wisconsin Power Corporation, and the Winona Gas Light and Coke Company. The Minnesota office of the company will be maintained at Winona. A. E. Pierce, of Eau Claire, vice-president of the company, will have active management of the newly acquired properties. All of the companies acquired have been controlled by the American Public Utilities Co., and the consolidation is made so that better operating results may be obtained.

THE United Gas Improvement Company has declared the regnlar quarterly dividend of 2 per cent., payable January 15, 1915. to stockholders of record as of December 31, 1914.

THERE are persistent reports in New York and Columbus, Ohio, that the Cities Service Company, which is the owner of the Denver Gas and Electric Light Company, will soon resume payments of the dividends on both classes of its stock, which were discontinued at the outbreak of the European war. The officers of the company have not countenanced these reports nor have they denied them, but that they are believed by investors is evidenced by the fact that there has been considerable activity in the shares, which have advanced until the preferred is selling at $55 to $58 a share,while the common is quoted at $49 to $53. The report of the company for October, just issued, shows the gross earnings to be $300,211.90, as compared with $162,468 a year ago. Net earnings were $289,821, as compared with $153,700. Interest charges were $40,833, as against $15,828, leaving the net to stock $248,897, as compared with $137,881. For twelve months ending October 31, net earnings were $3,837,883; expenses, $103,056; interest, $396,666; leaving $3,341,216 net to stock. The surplus account on that date was $2,342,899 after deducting $1,641,992 paid and accrued dividends on the preferred stock, and $610,997 paid to common shareholders, during the twelve months' period.

THERE was one sale of Pacific Gas and Electric common stock on the Chicago Exchange last week at 40½. This is the first official transaction since the close in July. The minimum price for trading is 35 and the shares sold as low as 30 on the curb during the recent depression. According to those who are informed, the California utilities corporation's finances are in excellent shape, and good progress is being made with development work, which will add large earning power.

AN evidence of returning confidence in the securities market on the part of public service corporations is seen in the approval last week by the up-State New York Public Service Commission of a number of new issues. The largest of these was on an application made Nov. 24 by the Buffalo, Rochester & Pittsburgh Railway Company, to issue $1,000,000 4½ per cent. 50 year consolidated mortgage bonds, at a price to be hereafter fixed, to provide for an expenditure equivalent to slightly more than the par value of the bonds, to reimburse the treasury for payments for investment in road and for minor purposes. An issue of $310,000 was authorized by the Northern New York Utilities, Inc., consisting of $200,000 5 per cent. 50 year first mortgage bonds, to be sold at not less than 90; $80,000 of cumulative 7 per cent. preferred stock, and $50.000 common stock. The proceeds are to be used for the acquisition of the stock, franchises, plant and equipment of the Carthage Electric Light and Power Company, and its obligations. The Carthage company will dissolve. The Rochester Railway and Light Company, by an issue of $250,000 5 per cent. 50 year consolidated trust mortgage bonds, is authorized to refund a like amount of underlying bonds of the Brush Electric Light Co., maturing Jan. 15, 1915. The new bonds are to be sold at not less than 95. Should the holders of the underlying bonds not be willing to exchange for the new bonds at 95, permission is given to enter into agreement with such holders for an extension for one year at an increase from 5 to 6 per cent. in interest on the old bonds. The Olean Electric Light and Power Company is authorized to issue $10,200 par value of its 6 per cent. 30-year first and refunding mortgage bonds, at not less than 80, to aid in meeting certain bills and accounts payable, not properly chargeable to operating expense or income.

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